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Including 26 regular issues of MACHINE DESIGN plus four special issues—*The Electric Motors Reference Issue*, *Bearings Reference Issue*, *Fluid Power Reference Issue*, and *The Plastics Reference Issue*. Only articles and editorial items one-half page or larger are indexed.

AUTHOR INDEX

A

- Allard, Gordon H.—"Regenerative Air-Hydraulic Clamping System," Aug. 1, p. 99
Alm, Gerald V.—"Grown Together Joints Grow Up," Jan. 4, p. 100
Anderson, William J. and Erwin V. Zaretsky—"Rolling-Element Bearings," *Bearings Reference Issue*, June 13, p. 22
"EHD Lubrication," Nov. 7, p. 187
Andrews, Donald E.—"Metal Conveyor Belts," Feb. 29, p. 141
Angel, Henry R.—"Mass Moment of Inertia," May 23, p. 200
Antonetti, V. W.—"Optimizing Heat-Exchanger/Blower Combinations," Sept. 12, p. 169
Aronson, Robert
"Our Changing Arsenal," May 9, p. 20
"Moving The Marines," Dec. 5, p. 20
Ashby, John D.—"Standard Relays for Special Purposes," June 20, p. 139

B

- Backus, John K. and Earl C. Haag—"Urethanes," *Plastics Reference Issue*, Dec. 12, p. 100
Bainbridge, R. W.—"Phenolics," *Plastics Reference Issue*, Dec. 12, p. 94
Baird, Worth—"Perforated Tape Drives," Apr. 11, p. 234
Barnes, Sam
"The Maritime Mess," Jan. 4, p. 22
"The Army's Wacky Watercraft," Feb. 15, p. 20
"Mining Marine Minerals," Apr. 25, p. 21
"The Health Of Humans"
Part 1: "Parts For People," June 20, p. 40
Part 2: "Parts For People," July 18, p. 20
Part 3: "Parts For People," Aug. 15, p. 40
Part 4: "The High Cost of Hospitals," Sept. 12, p. 42
"Sealab III: Deeper And Longer," Oct. 24, p. 20
Beacham, H. H. and J. L. Thomas—"Allylics," *Plastics Reference Issue*, Dec. 12, p. 87
Behrendt, H. R. and G. L. Taft—"Compressors," *Fluid Power Reference Issue*, Sept. 19, p. 83
Benford, Robert L.—"Customized Motions," Sept. 26, p. 151
Benzer, William C.—"High-Strength Low-Alloy Steels," Sept. 12, p. 174
Bergmann, H. R. and E. J. Wellauer—"Gear Materials: Ferrous Metals," June 20, p. 143
Bernstein, Saul S. and Martin M. Mirsky—"Reducing Electric-Motor Interference," June 6, p. 148
Bickford, John H.—"Impact," May 9, p. 165
"12 Ways To Go 1 Way," Aug. 1, p. 112
"1-Turn Devices," Nov. 21, p. 229
Black, M. K. and S. B. Neff—"Copolymers," *Plastics Reference Issue*, Dec. 12, p. 43
"Cellulose Acetate," *Plastics Reference Issue*, Dec. 12, p. 47
"Cellulose Propionate," *Plastics Reference Issue*, Dec. 12, p. 48
Bollinger, J. G. and J. A. Bonesho—"Self-Optimizing Vibration Damp-er," Feb. 29, p. 123
Bonesho, J. A. and J. G. Bollinger—"Self-Optimizing Vibration Damp-er," Feb. 29, p. 123
Bonkowski, W. S. and J. M. Zoppa—"Taming Temperature," Dec. 5, p. 159
Booser, E. R.—"Plain-Bearing Materials," *Bearings Reference Issue*, June 13, p. 15
Bordner, Paul G., Gary C. Fulmer, and David Meadows—"Plastic Profile Extrusions," June 6, p. 154
Bouvier, Leon—"Close-Tolerance Castings," Feb. 29, p. 137
Bowers, M. D. and W. P. Siegel—"Special-Purpose Motors: Clutch and Brake Motors," *Electric Motors Reference Issue*, Mar. 21, p. 49
Brackl, K. A.—"Pneumatic Systems—Air Preparation," July 18, p. 171
Bradbury, B. W.—"Insulation and Temperature Rise," *Electric Motors Reference Issue*, Mar. 21, p. 8
Brehmer, John R.—"Lubricating Devices," *Bearings Reference Issue*, June 13, p. 63
Breiner, Thomas C.—"Specialty Bearings: Large-Diameter Bearings," *Bearings Reference Issue*, June 13, p. 52
Bringer, Robert P.—"CTFE Resins," *Plastics Reference Issue*, Dec. 12, p. 59
Brockway, E. M., D. S. L. Durie, Paul R. Yoder Jr., John D. Hayes, and O. A. Ulrich—"Optomechanical Design," May 23, p. 165
Brown, B. F.—"Metals and Corrosion," Jan. 18, p. 165
Brown, Robert G., William H. Holstein, Jr., and T. Jerry Linton—"TFE-FEP Fluorocarbons," *Plastics Reference Issue*, Dec. 12, p. 54
Buisker, R. A.—"Speeding Up Electric Clutches and Brakes," July 4, p. 96
Bulkeley, Charles W.—"Vinyls," *Plastics Reference Issue*, Dec. 12, p. 80
Burgess, John A.—"Making the Most of Design Reviews," July 4, p. 90
"Designing for Contamination Control," Oct. 24, p. 193

C

- Campbell, F. L. (John)—"Fractional-Horsepower Induction Motors," *Electric Motors Reference Issue*, Mar. 21, p. 10
- Campbell, Jon—"Trends in Electric Motors," *Electric Motors Reference Issue*, Mar. 21, p. 3
- "Motor Protection," *Electric Motors Reference Issue*, Mar. 21, p. 88
- Carlyon, George—"Molding, Fabricating, and Decorating," *Plastics Reference Issue*, Dec. 12, p. 17
- Carswell, D. D.—"Snap-on Wear Strips," Feb. 1, p. 119
- "Nylons," *Plastics Reference Issue*, Dec. 12, p. 62
- Castellano, E. N. and H. Woellmer—"Electroforming," Aug. 29, p. 93
- Chandler, Robert—"Design for Numerical-Control Machining," Feb. 15, p. 157
- Coleman, S. D.—"Greek Numbers Game," Feb. 15, p. 188
- Cook, Donald V. and Bart G. Guerrieri—"Deflection in Gasketed Joints," Mar. 14, p. 149
- Cook, O. H., C. L. Harmsworth, and S. W. McClaren—"Titanium Castings," June 20, p. 166
- Coppa, Anthony P.—"New Ways To Soften Shock," Mar. 28, p. 130
- Courtright, J. R., N. W. Todd, D. M. Hamlin, and R. S. Mailouk—"Polyimides," *Plastics Reference Issue*, Dec. 12, p. 71
- Cox, R. G.—"Hose, Fittings, and Couplings," *Fluid Power Reference Issue*, Sept. 19, p. 65
- Crossman, Col. Jim—"Small-Cannon Comeback," Aug. 1, p. 37
- Crowan, A. C.—"Phenylene Oxides," *Plastics Reference Issue*, Dec. 12, p. 85

D

- D'Aprix, Roger M.—"You Need 'Overkill' in Communications," Feb. 15, p. 150
- Davis, Glenn I. and C. Austin Sprang—"Reinforced Plastics," *Plastics Reference Issue*, Dec. 12, p. 32
- Davis, J. F.—"Integral-Horsepower D-C Motors," *Electric Motors Reference Issue*, Mar. 21, p. 36
- Davis, J. R., C. J. King—"Heat Exchangers," *Fluid Power Reference Issue*, Sept. 19, p. 59
- Dean, Guy F.—"The Logic of Fluidic Circuit Design," Sept. 26, p. 158
- DeHart, A. O.—"Basic Bearing Types," *Bearings Reference Issue*, June 13, p. 4
- Delagi, Richard G.—"Clad Metals," Nov. 21, p. 133
- Dexter, Richard D.—"Eyelets," July 18, p. 183
- Di Bartolo, E. A.—"Flow-Control Valves," *Fluid Power Reference Issue*, Sept. 19, p. 38
- Dilpare, Armand L.—"Maximum-Work Springs," July 4, p. 111
- DiSapio, Alfred—"Lubricants: Solid and Bonded-Film Lubricants," *Bearings Reference Issue*, June 13, p. 59
- DiTorro, D. A.—"Valves," *Fluid Power Reference Issue*, Sept. 19, p. 93
- Dollinger, L. L.—"Filters," *Fluid Power Reference Issue*, Sept. 19, p. 56
- Dourlet, Ernest F.—"Selecting Plastics," *Plastics Reference Issue*, Dec. 12, p. 4
- Dreger, Don—"The First Hundred Years," *Plastics Reference Issue*, Dec. 12, p. 3
- Durie, D. S. L., Paul R. Yoder Jr., John D. Hayes, O. A. Ulrich, and E. M. Brockway—"Optomechanical Design," May 23, p. 165

E

- Easton, L. H. and A. L. Serok—"Universal Motors," *Electric Motors Reference Issue*, Mar. 21, p. 19
- Eglen, Jan Alan—"Just Getting Off The Ground," July 18, p. 40
- Ekstrom, Ralph E.—"Basic Course in Numerical Methods"
- Lesson 5: "Matrix Inversion," Jan. 4, p. 129
- Lesson 6: "Jacobi Iterative Method," Jan. 18, p. 193
- Lesson 7: "Eigenvalues of Matrices," Feb. 1, p. 116
- Lesson 8: "Nonlinear Equations," Feb. 15, p. 189
- Lesson 9: "Euler-Cauchy Methods," Feb. 29, p. 149
- Lesson 10: "Runge-Kutta Method," Mar. 14, p. 185
- Lesson 11: "Initial-Value Problems," Mar. 28, p. 159
- Lesson 12: "Finite Differences," Apr. 11, p. 245
- Lesson 13: "Boundary-Value Problems," Apr. 25, p. 177
- Lesson 14: "Elliptic Equations," May 9, p. 185
- Lesson 15: "Parabolic Equations," May 23, p. 201
- Lesson 16: "Hyperbolic Equations," June 6, p. 177
- Lesson 17: "FORTRAN Programs," June 20, p. 175
- Engbreton, M. E.—"Power Units," *Fluid Power Reference Issue*, Sept. 19, p. 78
- Ezekiel, F. D., R. E. Rosensweig, and G. Miskolczy—"Magnetic-Fluid Seals," Mar. 28, p. 145

F

- Ferguson, C. Ronald—"Homopolymers," *Plastics Reference Issue*, Dec. 12, p. 41
- Fox, Ora R. Jr.—"Self-Locking Bolts," Mar. 14, p. 177
- Foxwell, Vaughn M. Jr.—"Low-Frequency Fatigue Testing," May 9, p. 175
- Fried, N.—"Structures of Reinforced Plastics," Jan. 18, p. 178
- Fulmer, Gary C., Paul G. Bordner, and David Meadows—"Plastic Profile Extrusions," June 6, p. 154

G

- Gambrell, Samuel C. Jr.—"Why Bolts Loosen," Oct. 24, p. 163
- Gattis, Murrab—"As Others See Us," Aug. 15, p. 136
- Gatzow, Harold F.—"Avoid Design Duplication," July 18, p. 152
- Gegel, H. L., T. Lynch, and H. B. Kirkpatrick—"Stress Corrosion," July 18, p. 188
- Glie, Rowen—"New Status for Standardization," June 20, p. 134
- Glaeser, William A.—"Plain Bearings," *Bearings Reference Issue*, June 13, p. 8
- Gorham, W. F.—"Parylenes," *Plastics Reference Issue*, Dec. 12, p. 65
- Gray, Stanley—"Gas Bearing Applications," Apr. 25, p. 141
- Griffith, Spencer R.—"Reproduction Equipment," Oct. 10, p. 198
- "Microfilm Equipment," Oct. 10, p. 207
- Guerrieri, Bart G. and Donald V. Cook—"Deflection in Gasketed Joints," Mar. 14, p. 149

H

- Haag, Earl C. and John K. Backus—"Urethanes," *Plastics Reference Issue*, Dec. 12, p. 100
- Hahlbeck, Edwin C.—"Gears Are Not Perfect," Nov. 21, p. 146
- Hamlin, D. M., R. S. Mailouk, J. R. Courtright, and N. W. Todd—"Polyimides," *Plastics Reference Issue*, Dec. 12, p. 71
- Hanson, K. L. and G. L. Oscarson—"Synchronous Motors," *Electric Motors Reference Issue*, Mar. 21, p. 32
- Harland, Philip W.—"Pressure Gages," *Fluid Power Reference Issue*, Sept. 19, p. 69
- Harmsworth, C. L., S. W. McClaren, and O. H. Cook—"Titanium Castings," June 20, p. 166
- Harris, T. A.—"Misaligned Roller Bearings," Aug. 29, p. 98
- Harsh, Robert C.—"Understanding Hydraulic-System Shocks," Feb. 15, p. 153
- Hayes, Frank O.—"Don't Send An Engineer To Do a Technician's Job," Aug. 1, p. 86
- Hayes, John D., O. A. Ulrich, E. M. Brockway, D. S. L. Durie, and Paul R. Yoder Jr.—"Optomechanical Design," May 23, p. 165
- Henke, Russell W.—"Trends in Fluid Power," *Fluid Power Reference Issue*, Sept. 19, p. 3
- Henke, Russell W. and Jack Johnson—"Basic Instrumentation for Fluid Power Systems"
- Part 1: "Signal Generation," Jan. 4, p. 110
- Part 2: "Signal Processing and Readout," Feb. 1, p. 100
- Part 3: "Electronic Counters and Recorders," Feb. 15, p. 181

- Heyson, A. E.—"Measuring Conformance to Standards," Sept. 12, p. 164
- Hibberd, Robert G.—"Basic Course in Integrated Circuits"
- Lesson 1: "The Impact of Integrated Circuits," Sept. 26, p. 129
- Lesson 2: "Solid-State Technology," Oct. 24, p. 185
- Lesson 3: "Elements of Integrated Circuits," Nov. 7, p. 179
- Lesson 4: "Formation of Integrated Circuits," Nov. 21, p. 155
- Lesson 5: "Digital Logic Circuits," Dec. 5, p. 167
- Lesson 6: "Transistor Logic Circuits," Dec. 19, p. 139

- Hill, Roy O. Jr.—"Cellulose Acetate Butyrate," *Plastics Reference Issue*, Dec. 12, p. 51
- Hofer, K. E. Jr.—"Equations for Fracture Mechanics," Feb. 1, p. 109
- Hohmann, C. J., H. J. Schuthorpe, D. G. Snow, H. L. Von Hoene—"Pump Selection," *Fluid Power Reference Issue*, Sept. 19, p. 7
- Holstein, William H. Jr., Robert G. Brown, and T. Jerry Linton—"TFE-FEP Fluorocarbons," *Plastics Reference Issue*, Dec. 12, p. 54
- Hope, John A.—"Specialty Bearings: Rolling-Element Linear-Motion Bearings," *Bearings Reference Issue*, June 13, p. 50
- Horn, Norbert W.—"Gear Pumps," *Fluid Power Reference Issue*, Sept. 19, p. 10
- Houston, John S.—"Polypropylenes," *Plastics Reference Issue*, Dec. 12, p. 74
- Hughes, Charles W.—"High Temperature in Hydraulic Systems," Dec. 5, p. 134
- Hughes, Raleigh C. and Stephen L. Pop—"Special-Purpose Motors: Torque Motors," *Electric Motors Reference Issue*, Mar. 21, p. 53

I

- Irwin, Jack—"Integrated Circuits," Aug. 15, p. 144

J

- Jacobellis, A. A.—"Accumulators," *Fluid Power Reference Issue*, Sept. 19, p. 18
- Johnson, Jack and Russ W. Henke—"Basic Instrumentation for Fluid Power Systems"
- Part 1: "Signal Generation," Jan. 4, p. 110
- Part 2: "Signal Processing and Readout," Feb. 1, p. 100
- Part 3: "Electronic Counters and Recorders," Feb. 15, p. 181
- Johnson, William R.—"Porous Metal Parts," Apr. 11, p. 225
- Josephs, Ben—"Job Shopping: Route to Wealth or Worry?," Jan. 4, p. 94

K

- Kauffman, Jack—"Basic Course in Hydraulic Systems"
- Lesson 1: "Introduction to Hydraulics," Feb. 29, p. 129
- Lesson 2: "Pumps and Their Application," Mar. 14, p. 180
- Lesson 3: "Pumps and Their Application (Continued)," Mar. 28, p. 151
- Lesson 4: "Hydraulic Cylinders," Apr. 11, p. 229
- Lesson 5: "Rotary Actuators and Motors," Apr. 25, p. 173
- Lesson 6: "Direction-Control Valves," May 9, p. 179
- Lesson 7: "Direction Control Valve Application," May 23, p. 197
- Lesson 8: "Flow-Control Valves," June 6, p. 171
- Lesson 9: "Pressure-Control Valves," June 20, p. 161
- Lesson 10: "Pressure-Control Valves (continued)," July 4, p. 123
- Lesson 11: "Hydraulic System Fluids," July 18, p. 195
- Lesson 12: "Fluid Conductors," Aug. 15, p. 168
- Lesson 13: "Fluid Conductors," (continued), Aug. 29, p. 107
- Lesson 14: "Fluid Conditioners—Strainers and Filters," Sept. 12, p. 197

- Lesson 15: "Fluid Conditioners—Heat Exchangers," Sept. 26, p. 167
- Kavanaugh, Richard J. and Robert W. Perkins—"Special-Purpose Motors: Timing and Stepper Motors," *Electric Motors Reference Issue*, Mar. 21, p. 62
- Kelsey, Ray A.—"Using an Outside Consultant," May 23, p. 158
- Kenny, Robert J.—"Fans and Blowers," Mar. 14, p. 151
- "Noise in Air-Moving Systems," Sept. 26, p. 138
- Ketcham, Richard L. and Joseph L. Seminara—"Combating Confusion in Control Panels," Apr. 11, p. 240
- Khol, Ronald—"Understanding Photoelasticity," Oct. 24, p. 168
- "Computer Stress Analysis," Nov. 21, p. 136
- King, C. J., J. R. Davis—"Heat Exchangers," *Fluid Power Reference Issue*, Sept. 19, p. 58
- King, N. E.—"Chlorinated Polyether," *Plastics Reference Issue*, Dec. 12, p. 52
- Kinsey, R. H.—"Ionomers," *Plastics Reference Issue*, Dec. 12, p. 61
- Kirkpatrick, H. B., H. L. Gegel, and C. T. Lynch—"Stress Corrosion," July 18, p. 188
- Kiwalke, Jozef—"Inertia Welding," Nov. 7, p. 161

- Klein, Stanley
 "Technology for the Blind: Beyond the Stick and the Dot," Feb. 1, p. 20
 "Technology Invades the Arts," Feb. 29, p. 37
 "Chaos In Engineering," May 23, p. 20
 "Affluent Leisure," July 4, p. 20
 "Technology Comes to Wall Street," Sept. 12, p. 20
 "Outlook For Communications," Nov. 7, p. 19
 Koehler, Robert—"Gear Quality," Dec. 5, p. 123
 Kordatzky, Robert W.—"Subfractional-Horsepower A-C Motors," Feb. 1, p. 96
 Kriebel, Robert H.—"Anaerobic Adhesives," Apr. 25, p. 161
 Kung, Wei-Chi, "Deflection of Conical Springs," Aug. 15, p. 159

L

- Lachowecki, Walter—"Reinforced Thermoplastics," *Plastics Reference Issue*, Dec. 12, p. 34
 Lamkey, F. R.—"Integral-Horsepower Induction Motors," *Electric Motors Reference Issue*, Mar. 21, p. 23
 Landers, Richard R.—"Organize Against Product Failure," June 6, p. 136
 Laughtmann, Ralph—"Rotary Actuators," *Fluid Power Reference Issue*, Sept. 19, p. 32
 Lavioie, Francis J.
 "Engineer's Guide to Time-Sharing," Feb. 29, p. 114
 "Gear Materials: Nonferrous Metals," June 20, p. 157
 "Mechanical Adjustable-Speed Drives," Sept. 12, p. 186
 "Drafting Machines," Oct. 10, p. 191
 "Calculators And Computers," Oct. 10, p. 184
 "High-Velocity Forging: New Force in Gear Technology," Dec. 5, p. 146
 LeFell, C. K.—"Tubular Metal Parts," Dec. 5, p. 152
 Leibfritz, K. W.—"Pneumatic Systems: Air Supply," July 13, p. 167
 Levy, Samuel J.—"Geometric Dimensioning," Sept. 12, p. 204
 Linton, T. Jerry, Robert G. Brown, and William H. Holstein, Jr.—"TFE-FEP Fluorocarbons," *Plastics Reference Issue*, Dec. 12, p. 54
 Little, R. E.—"Parts That Bend and Twist," Nov. 7, p. 174
 Long, Melvin E.—"Graphic Symbols," *Fluid Power Reference Issue*, Sept. 19, p. 5
 Lower, Donald P.—"Specialty Bearings: Premounted Bearings," *Bearings Reference Issue*, June 13, p. 46
 Lustig, Robert—"Reservoirs," *Fluid Power Reference Issue*, Sept. 19, p. 53
 Lynch, C. T., H. B. Kirkpatrick, and Gegel, H. L.—"Stress Corrosion," July 18, p. 188

M

- MacMeans, C. W.—"Adjustable-Speed Drives," *Electric Motors Reference Issue*, Mar. 21, p. 68
 Madden, John J.—"Epoxyes," *Plastics Reference Issue*, Dec. 12, p. 92
 Malinowski, Les—"Pneumatic Systems—Air Control," July 18, p. 176
 Mallouk, R. S., J. R. Courtright, N. W. Todd, and D. M. Hamlin—"Polyimides," *Plastics Reference Issue*, Dec. 12, p. 71
 Martinelli, J. A.—"Safe Loads For Thin-Wall Cylinders," Aug. 1, p. 116
 Matt, Richard J.—"Engineering Project Reports," Nov. 7, p. 157
 Matthews, Robert W.—"Special-Purpose Motors: Instrument Motors," *Electric Motors Reference Issue*, March 21, p. 58
 McClaren, S. W., O. H. Cook, and C. L. Harmsworth—"Titanium Castings," June 20, p. 166
 McMacken, D. C.—"Fluids," *Fluid Power Reference Issue*, Sept. 19, p. 75
 Mea, Anthony N.—"Special-Purpose Motors: Servomotors," *Electric Motors Reference Issue*, Mar. 21, p. 55
 Meadows, David, Gary C. Fulmer, and Paul G. Bordner—"Plastic Profile Extrusions," June 6, p. 154
 Meisel, William—"Synchronizing Hydraulic Actuators," June 6, p. 166
 Mirsky, Martin M. and Saul S. Bernstein—"Reducing Electric-Motor Interference," June 6, p. 148
 Miskolczy, G., F. D. Ezekiel, and R. E. Rosensweig—"Magnetic-Fluid Seals," Mar. 28, p. 145
 Morley, James P. and Charles F. Romine—"Thermal Distortion," Dec. 5, p. 173
 Morrison, Ralph A.—"Load/Life Curves For Gear and Cam Materials," Aug. 1, p. 102
 Muller, George J.—"Laminated Plastics," *Plastics Reference Issue*, Dec. 12, p. 28
 Mungenast, John and William Smith—"Voltage Control of Induction Motors," Apr. 25, p. 167
 Muraoka, James S.—"Effects of Marine Organisms," Jan. 18, p. 184

N

- Neff, S. B. and M. K. Black—"Copolymers," *Plastics Reference Issue*, Dec. 12, p. 43
 "Cellulose Acetate," *Plastics Reference Issue*, Dec. 12, p. 47
 "Cellulose Propionate," *Plastics Reference Issue*, Dec. 12, p. 48
 Nicol, John—"Pipe, Tubing, and Fittings," *Fluid Power Reference Issue*, Sept. 19, p. 61
 Nufer, A. and G. B. Sunderland—"Aminos," *Plastics Reference Issue*, Dec. 12, p. 89

O

- Olson, John and Dudley Pease—"Piston Pumps," *Fluid Power Reference Issue*, Sept. 19, p. 16
 Oscarson, G. L. and K. L. Hanson—"Synchronous Motors," *Electric Motors Reference Issue*, Mar. 21, p. 32
 Osteen, E. L.—"Ethyl Cellulose," *Plastics Reference Issue*, Dec. 12, p. 49

P

- Pease, Dudley and John Olson—"Piston Pumps," *Fluid Power Reference Issue*, Sept. 19, p. 16
 Pearson, Robert H.—"Avoiding Gear Overdesign," May 9, p. 153
 Pennisi, J. M.—"Mass Moment of Inertia," Jan. 4, p. 125
 Perkins, Robert W. and Richard J. Kavanaugh—"Special-Purpose Motors: Timing and Stepper Motors," *Electric Motors Reference Issue*, Mar. 21, p. 62
 Perle, Richard J.—"Reliable Limit-Switch Operation," Nov. 7, p. 185
 Peters, Robert L.—"Defining Design Safety," Feb. 29, p. 128
 Pierson, Orville L.—"Acrylics," *Plastics Reference Issue*, Dec. 12, p. 45

- Pierson, Robert R.—"Specialty Bearings: Instrument Bearings," *Bearings Reference Issue*, June 13, p. 40
 Piaro, Joseph F.—"Ethylene/Vinyl Acetate," *Plastics Reference Issue*, Dec. 12, p. 53
 Pippenger, J. J.—"Pressure-Control Valves," *Fluid Power Reference Issue*, Sept. 19, p. 35
 Pittwood, D. G.—"How To Build an Adjustable Ellipsograph," June 20, p. 173
 Polentz, Lloyd M.—"Don't Let the P.E. Exam Scare You," Apr. 11, p. 212
 Poli, Emil L.—"Polyethylenes," *Plastics Reference Issue*, Dec. 12, p. 68
 Polini, Eugene T. Jr.—"Short-Run Diecastings," May 9, p. 158
 Pollock, Kenneth G.—"Glassy Materials for Hydrospace," Jan. 18, p. 174
 Ponstingl, John C.—"D-C Motor Controls," *Electric Motors Reference Issue*, Mar. 21, p. 82
 Pop, Stephen L. and Raleigh C. Hughes—"Special-Purpose Motors: Torque Motors," *Electric Motors Reference Issue*, Mar. 21, p. 53
 Porter, Eric—"Fractional-Horsepower D-C Motors," *Electric Motors Reference Issue*, Mar. 21, p. 16

R

- Rammath, H. G.—"Polycarbonates," *Plastics Reference Issue*, Dec. 12, p. 67
 Rasmussen, Svein B.—"Budgeting and Control of Development Projects," Aug. 29, p. 78
 Raudsepp, Eugene
 Problems with Communications:
 "Part 1—Mismanaging the Process," Mar. 14, p. 145
 "Part 2—Getting through to Supervisors," Mar. 28, p. 126
 "Channeling Technical Information," Apr. 25, p. 138
 "How To Sharpen Your Listening Skills," May 9, p. 148
 "Creating an Environment for Creativity," Sept. 26, p. 124
 "Assessing the Value of Advanced Degrees," Oct. 24, p. 158
 "Creative Problem Solving," Nov. 21, p. 124
 "How's Your Management Potential," Dec. 5, p. 138
 Reinking, Robert F.—"Designing With Explosive Devices," July 4, p. 116
 Rexroad, William D.—"Don't Evaluate Without the Facts," Feb. 29, p. 121
 Ringer, A. G.—"Motors," *Fluid Power Reference Issue*, Sept. 19, p. 89
 Rollins, James E.—"Lubricants: Oils and Greases," *Bearings Reference Issue*, June 13, p. 57
 Romine, Charles F. and James P. Morley—"Thermal Distortion," Dec. 5, p. 173
 Rondeau, Herbert F.—"Calculate the Profitability Index," Feb. 1, p. 88
 Rosensweig, R. E., G. Miskolczy, and F. D. Ezekiel—"Magnetic-Fluid Seals," Mar. 28, p. 145
 Rumbarger, John H.—"Trends in Bearings and Lubrication," *Bearings Reference Issue*, June 13, p. 3
 Rumbarger, John H. and George Wertwijn—"Hydrostatic Lead Screws," Apr. 11, p. 218
 Russell, Harold—"What Metal Is That?," Aug. 15, p. 161

S

- Sackman, Harold—"Time-Sharing or Small Computer?," Nov. 7, p. 148
 Sampson, Merritt B.—"Boosters," *Fluid Power Reference Issue*, Sept. 19, p. 21
 Saroyan, John S.—"Protective Coatings," Jan. 18, p. 188
 Schermerhorn, Robert S. and Martin I. Taft—"Systematic Subjectivity—Measuring Design Intangibles," Dec. 5, p. 108
 Schulthorpe, H. J., D. G. Snow, H. L. Von Hoenes, C. J. Hohmann—"Pump Selection," *Fluid Power Reference Issue*, Sept. 19, p. 7
 Seminara, Joseph L. and Richard L. Ketcham—"Combating Confusion in Control Panels," Apr. 11, p. 240
 Serok, A. L. and L. H. Easton—"Universal Motors," *Electric Motors Reference Issue*, Mar. 21, p. 19
 Siegel, W. P. and M. D. Bowers—"Special-Purpose Motors: Clutch and Brake Motors," *Electric Motors Reference Issue*, Mar. 21, p. 49
 Smith, Jane—"Planning and Layout," Oct. 10, p. 176
 "Equipment Roundup," Oct. 10, p. 214
 Smith, F. Russell—"Specialty Bearings: Unground Ball Bearings," *Bearings Reference Issue*, June 13, p. 54
 Smith, R. H.—"Direction-Control and Servovalves," *Fluid Power Reference Issue*, Sept. 19, p. 43
 Snow, D. G., H. J. Schulthorpe, H. L. Von Hoenes, C. J. Hohmann—"Pump Selection," *Fluid Power Reference Issue*, Sept. 19, p. 7
 Souza, Alfred, Jr.—"Alkyds," *Plastics Reference Issue*, Dec. 12, p. 86
 Spector, Leo F.
 "The Race of the Super Atom-Smashers," Feb. 15, p. 28
 "The Battle of the Sound Systems," Mar. 14, p. 46
 "Radiation Around The Home," Apr. 11, p. 46
 "Probing Secrets Of The Atom," June 6, p. 38
 "Industrial Espionage-1—The Big Steal," Aug. 15, p. 20
 "Industrial Espionage-2—The Security Game," Aug. 29, p. 42
 "Toward The Automated Home," Nov. 21, p. 21
 Speth, William and John Mungenast—"Voltage Control of Induction Motors," Apr. 25, p. 167
 Sprang, C. Austin and Glenn I. Davis—"Reinforced Thermosets," *Plastics Reference Issue*, Dec. 12, p. 32
 Stanford, C. P., Dr.—"Plan Ahead to Make Research Pay," July 18, p. 157
 Starr, Dale L.—"Predicting Burst Strength," Aug. 15, p. 173
 Sulser, M. G.—"Hydraulic Motors," *Fluid Power Reference Issue*, Sept. 19, p. 28
 Sunderland, G. B. and A. Nufer—"Aminos," *Plastics Reference Issue*, Dec. 12, p. 89

T

- Taft, G. L. and H. R. Behrendt—"Compressors," *Fluid Power Reference Issue*, Sept. 19, p. 83
 Taft, Martin I. and Robert S. Schermerhorn—"Systematic Subjectivity—Measuring Design Intangibles," Dec. 5, p. 108
 Tennerstedt, M. R.—"Special-Purpose Motors: Gearmotors," *Electric Motors Reference Issue*, Mar. 21, p. 45
 Thomas, J. L. and H. H. Beacham—"Allylics," *Plastics Reference Issue*, Dec. 12, p. 87
 Todd, N. W., D. M. Hamlin, R. S. Mallouk, and J. R. Courtright—"Polyimides," *Plastics Reference Issue*, Dec. 12, p. 71
 Tutthill, A. H.—"Marine Corrosion," Dec. 5, p. 117
 Tuttle, S. B.—"Generating Polygons With Hypo-cycloids," May 9, p. 173

U

- Ullrich, O. A., E. M. Brockway, D. S. L. Durie, Paul R. Yoder Jr., and John D. Hayes—"Optomechanical Design," May 23, p. 165
Updegraff, I. H.—"Polyesters," *Plastics Reference Issue*, Dec. 12, p. 96

V

- Valentich, J.—"Testing With Telemetry," Aug. 29, p. 83
Van Sickle, Robert W.—"Polystyrenes," *Plastics Reference Issue*, Dec. 12, p. 76
Vermillion, J. L.—"Polyallomers," *Plastics Reference Issue*, Dec. 12, p. 66
Von Hoene, H. L., H. J. Schulthorpe, D. G. Snow, and C. J. Hohmann—"Pump Selection," *Fluid Power Reference Issue*, Sept. 19, p. 7

W

- Walmer, Warren L.—"Rupture Discs," Aug. 29, p. 102
Walton, R. K.—"Polysulfones," *Plastics Reference Issue*, Dec. 12, p. 79
Waters, Odale D., Jr.—"Quest in the Innerspace," Jan. 18, p. 152
Watson, T. P.—"Linear Actuators," *Fluid Power Reference Issue*, Sept. 19, p. 24
Wellauer, E. J. and H. R. Bergmann—"Gear Materials: Ferrous Metals," June 20, p. 143
Wertwijn, George and John H. Rumbarger—"Hydrostatic Lead Screws," Apr. 11, p. 218
Weyer, D. E.—"Silicones," *Plastics Reference Issue*, Dec. 12, p. 98
Wilson, Warren E.—"Hydrostatic Transmissions," Mar. 28, p. 141
Whitney, James L.—"ABS," *Plastics Reference Issue*, Dec. 12, p. 39
Wickey, J. Ronald—"A-C Motor Controls," *Electric Motors Reference Issue*, Mar. 21, p. 76
Williams, Herman L.—"Assigning a Value to Human Reliability," July 4, p. 102

Wise, Clare E.

- "Interstellar Eavesdropping," Jan. 18, p. 20
"Special Report: Products Liability," Mar. 28, p. 20
"Steam Is Back," Aug. 29, p. 20
"Design For Speed and Profit," Nov. 7, p. 36
"Apollo 8—A Conservative Mission," Dec. 5, p. 20
Wise, Clare E. and Nat Wood—"The Great Turbine Derby," May 23, p. 42
Woellmer, H. and Castellano, E. N.—"Electroforming," Aug. 29, p. 93
Wood, Nat
"Man vs. Car: Where Safety Research Stops," Jan. 4, p. 44
"Tools for Working in Water," Mar. 14, p. 20
"Driverless Cars, Automated Roadways," Apr. 11, p. 20
"Submarine Rescue," June 6, p. 20
"Straight Up And Away," June 20, p. 20
"Flying Cars That Hug The Ground," Aug. 1, p. 20
Wood, O. L.—"Fluidic Devices," *Fluid Power Reference Issue*, Sept. 19, p. 102
Woodland, B. T.—"Deep-Submergence Metal Structures," Jan. 18, p. 159
Wood, Nat and Clare E. Wise—"The Great Turbine Derby," May 23, p. 42

Y

- Yoder, Paul R., Jr., John D. Hayes, O. A. Ullrich, E. M. Brockway, and D. S. L. Durie—"Optomechanical Design," May 23, p. 165

Z

- Zanin, Louis J.—"Cold-Headed Parts," Aug. 1, p. 95
Zaretzky, Erwin V. and William J. Anderson—"Rolling-Element Bearings," *Bearings Reference Issue*, June 13, p. 22
"EHD Lubrication," Nov. 7, p. 167
Zoppa, J. M. and W. S. Bonkowski—"Taming Temperature," Dec. 5, p. 159

SUBJECT INDEX

Numbers preceding the column heads refer to the MACHINE DESIGN *Subject Classification Systems* (January 1969).

Editorial material in this section is classified according to the following system:

1	2	3	4	5
Controlling Universal-Motor Speed	Adem	1/5	118	(6.0)

1. Title.

2. Author's last name (see Author Index for complete name). Departments in regular issues are denoted by the following code:

N/T	News/Trends
Scan	Scanning the Field for Ideas
DIA	Design in Action
DI	Design International
CD	Conference Digest
AD	Abstracts for Design

3. Date of issue, MACHINE DESIGN *Reference Issues* are denoted by the following code:

EM	Electric Motors (March 21)
B	Bearings (June 13)
FP	Fluid Power (September 19)
P	Plastics (December 12)

4. Page Number.

5. Number of pages in article or editorial item.

Electrical and Electronic Drives, Controls and Systems

11. Electric Motors

Trends in Electric Motors	Campbell EM 3/21	3	(2.0)
Fractional-Horsepower Induction Motors	Campbell EM 3/21	10	(6.0)
Fractional-Horsepower D-C Motors	Porter EM 3/21	16	(3.0)
Integral-Horsepower Induction Motors	Lamkey EM 3/21	23	(9.0)
Voltage Control of Induction Motors	Mungenast & Speth	4/25	167 (6.0)
Integral-Horsepower D-C Motors	Davis EM 3/21	36	(5.0)
Universal Motors	Sebok & Easton EM 3/21	19	(4.0)
Special-Purpose Motors: Gearmotors	Tennerstedt	EM 3/21	45 (4.5)
Spring Housing Delays Gearmotor Output	Scan	3/14	175 (1.0)
Special-Purpose Motors: Torque Motors	Pop & Hughes EM 3/21	53	(1.8)
Definite-Purpose Motors	(Chapter) EM 3/21	41	(4.0)

12. Power Supplies

The Fast Battery Chargers	DIA	8/29	14 (1.3)
Run Down of Electric-Car Batteries	CD	5/9	188 (2.0)
Light Solar-Cell Array Unfurls From Flat Pack	N/T	12/19	41 (0.5)
Jiggling Waves Power Signal Generator	Scan	4/25	160 (0.5)

13. Switches and Relays

D-C Motor Controls	Ponstingl EM 3/21	82	(6.0)
Standard Relays for Special Purposes	Ashby	6/20	139 (4.0)
Motor Protection	Campbell EM 3/21	88	(5.0)
Reliable Limit-Switch Operation	Perle	11/7	185 (5.0)
A-C Motor Controls	Wickey EM 3/21	76	(6.0)
Bearing Drag Flips Rotation-Direction Switch	Scan	2/1	115 (0.5)
Flipped Contacts Reverse Relay Operation	Scan	5/9	164 (0.7)
Swinging Switch Fashions Timer-Cam Profile	Scan	5/23	164 (0.6)

14. Instruments and Controls

Basic Instrumentation for Fluid Power Systems: Part 2—Signal Processing and Readout	Henke & Johnson	2/1	100 (9.0)
Electronics Slated To Take Over Car Controls	N/T	8/1	16 (0.5)
Testing With Telemetry	Valentich	8/29	82 (11.0)
Breeze Measure Corrects Tank's Computer	N/T	9/12	12 (0.7)
New Money Changer Catches All Counterfeits	N/T	10/10	52 (0.7)
Warped Flux Measures Torque	Scan	1/4	122 (1.0)
Mechanical Stutter Modulates Motion	Scan	1/4	123 (0.5)
Synchronous Motors	Oscarson & Hanson EM 3/21	32	(4.0)
Subfractional-Horsepower A-C Motors	Kordatzky	2/1	96 (4.0)
Special - Purpose Motors: Instrument Motors	Mathews	EM 3/21	58 (3.7)
Basic Instrumentation for Fluid Power Systems: Part 3—Electronic Counters and Recorders	Henke & Johnson	2/15	181 (7.0)
Combating Confusion in Control Panels	Seminara & Ketcham	4/11	240 (5.0)
Liquid Crystals Make Bright, Efficiency Displays	N/T	7/4	16 (1.0)

Scanning Light-Beam Measures Vibration	Scan	6/20	172 (1.0)
Beeper Measures Eyeballs	N/T	8/1	31 (1.0)
Waveform Mismatch Signals Inductive Fault	Scan	2/29	135 (0.7)
Coaxial Sensor Finds Leaky Circuit	Scan	6/6	147 (1.0)
Special-Purpose Motors: Servomotors	Mea	EM 3/21	55 (3.0)
Special-Purpose Motors: Timing and Stepper Motors	Kavanaugh & Perkins EM 3/21	62	(6.0)

15. 16. Circuit Components, Connectors and Wiring

Integrated Circuits	Irwin	8/15	143 (16.0)
Basic Course In Integrated Circuits			
Part 1—The Impact of Integrated Circuits	Hibberd	9/26	131 (9.0)
Part 2—Solid-State Technology	Hibberd	10/24	185 (7.0)
Part 3—Elements of Integrated Circuits	Hibberd	11/7	179 (6.0)
Part 4—Formation of Integrated Circuits	Hibberd	11/21	155 (6.0)
Part 5—Digital Logic Circuits	Hibberd	12/5	167 (6.0)
Part 6—Transistor Logic Circuits	Hibberd	12/19	139 (6.0)
Industrial and Synthetic Diamonds: Solid State's Best Friends?	N/T	3/28	10 (1.0)
Low-Cost Transistors Quick Printed on Tape	N/T	9/12	54 (2.0)
Roundup of Solid-State Devices	CD	6/6	180 (4.0)
Laser Creates Stresses, Cleaves Brittle Materials	N/T	5/9	10 (0.7)
Underground Cryogenic Cable May Carry Power to the Biggest Cities	N/T	5/23	10 (0.5)

17. General Components

Rotating Pole Pieces Propel Cards	Scan	2/29	134 (1.0)
Composite Magnets Form Flux Latch	Scan	2/29	136 (0.5)
Sliding Magnets Actuate Contour-Seeking Probes	Scan	9/12	203 (1.0)
Insulation and Temperature Rise	Bradbury	EM 3/21	8 (2.0)
Reducing Electric-Motor Interference	Bernstein & Mirsky	6/6	148 (6.0)
New Lamp Introduces 250 kw Of Continuous Light	N/T	6/20	16 (0.5)
Glowing Glass Replaces Burners	DIA	7/18	61 (1.0)
Special-Purpose Motors: Clutch and Brake Motors	Siegel & Bowers EM 3/21	49	(4.0)
Speeding Up Electric Clutches and Brakes	Bulsker	7/4	96 (6.0)
Magnetic Shunt Varies Clutch Torque	Scan	10/24	200 (1.0)

19. Systems, Drives, Assemblies

Ohmmeter Circuit Isolates Parallel Resistance	Scan	12/5	145 (0.7)
Design for Numerical-Control Machining	Chandler	2/15	157 (22.0)
Advanced NC Goes to Work	Article	12/19	130 (4.0)
Production 'Brain' Controls a Machine Tool	N/T	4/25	49 (0.5)
Integrated NC Manufacturing	CD	9/26	175 (3.5)
Noise Effects in Control Systems	CD	12/19	146 (3.0)
Typewriter-Size Calculator 'Thinks' Like a Computer	N/T	4/11	14 (1.3)
Adjustable-Speed Drives	MacMeans	EM 3/21	68 (8.0)
Servo Shuttle Shows Signal Strength	Scan	8/1	110 (0.5)

Fluid Drives, Controls and Systems

21. Fluids

Trends in Fluid Power	Henke	FP 9/19	3 (2.0)
Graphic Symbols	Long	FP 9/19	5 (2.0)
Basic Course in Hydraulic Systems: Part 11—Hydraulic System Fluids	Kauffman	7/18	195 (5.0)
Fluids	McMacken	FP 9/19	75 (3.0)

22. Fluid Conditioners

Conditioners	Chapter	FP 9/19	97 (5.0)
Reservoirs	Lustig	FP 9/19	53 (3.0)
Air Pressure Powers Pumpless Recirculator	Scan	7/18	186 (1.0)
Filters	Dollinger	FP 9/19	56 (2.0)
Charcoal Filters May Clean The Nation's Atmosphere	N/T	8/1	16 (0.5)
Optimizing Heat-Exchanger/Blower Combinations	Antonette	9/12	169 (5.0)
Heat Exchangers	King & Davis	FP 9/19	58 (3.0)

Basic Course in Hydraulic Systems:

Part 15—Fluid Conditioners: Heat Exchangers	Kauffman	9/26	167 (4.0)
Rejected Hardware Spawns Hot-Air Generators	DIA	1/4	42 (1.0)
Bubble Scrubbing Moves Dirt Away from Advancing Pure Ice	N/T	4/25	37 (0.6)
Inside-Out Burner Consumes Any Home's Liquid Fuel	N/T	10/10	10 (0.6)
Project Bubble: First Try At Solving Bathing-Area Pollution Problems	N/T	6/20	11 (0.3)

23. Fluid Conductors

Hose, Fittings, and Couplings	Cox	FP 9/19	65 (4.0)
Pipe, Tubing, and Fittings	Nicol	FP 9/19	61 (4.0)
Tiny Blood Vessels Allow No Clotting	N/T	12/19	42 (0.6)
Cartridge Blast Puts Circumferential Squeeze on Tubing	Scan	9/26	156 (0.5)
Springy Sleeve Forms Self-Gripping Sheath	Scan	9/26	156 (0.5)
Turbulent Swirl Slows Flow	Scan	7/18	187 (0.5)
Vortex Maxe Rectifies Alternating Fluid Flow	Scan	8/15	177 (0.6)

24. Linear Devices

Basic Course in Hydraulic Systems:			
Part 4—Hydraulic Cylinders	Kauffman	4/11 229	(5.0)
Piggyback Piston Stretches Ram Travel	Scan	9/26 157	(1.0)
Accumulators	Jacobellis	FP 9/19 18	(3.3)
Synchronizing Hydraulic Actuators	Meisel	6/6 166	(5.0)
Linear Actuators	Sampson	FP 9/19 21	(2.7)
Linear Actuators	Watson	FP 9/19 24	(4.0)
Linear Actuators	Watson	FP 9/19 86	(3.0)
Oscillating Solenoid Controls Hydraulic Slave	Scan	5/9 162	(1.0)
Piston Displacement Triggers Pneumatic Pounder	Scan	6/6 145	(1.0)
Piston Pumps	Olson & Pease	FP 9/19 18	(2.0)
Liquid Piston Pumps Fluids	Scan	9/26 153	(1.0)
Air Leak Controls Hole-Seeking Piston	Scan	3/28 156	(0.6)
Reversing Piston Measures Volume Continuously	Scan	4/25 160	(0.5)

25. Rotary Devices

Basic Course in Hydraulic Systems:			
Part 2—Pumps and Their Application	Kauffman	3/14 180	(5.0)
Part 3—Pumps and Their Application (continued)	Kauffman	3/28 151	(5.0)
Gear Pumps	Horn	FP 9/19 10	(3.0)
Vane Pumps	Peterson	FP 9/19 13	(3.0)
Pump Selection	Sculthorpe, Snow, Von Hoene & Hohmann	FP 9/19 7	(3.0)
Metal Pump Spins Out 400,000 lb/hr of Aluminum	N/T	3/28 12	(0.5)
Critical Test Passed by Nuclear-Power-plant Pump	N/T	9/12 58	(0.5)
A Pump With Class	DIA	10/24 61	(1.0)
Synchronized Seal Slots Pass Pistons	Scan	5/9 163	(1.0)
Motors	Ringer	FP 9/19 89	(4.0)
Hydraulic Motors	Sulser	FP 9/19 28	(4.0)
Compressors	Taft & Behrendt	FP 9/19 83	(3.0)
Basic Course in Hydraulic Systems:			
Part 5—Rotary Actuators and Motors	Kauffman	4/25 173	(4.0)
Rotary Actuators	Laughman	FP 9/19 32	(3.0)
Stop That Plane	N/T	4/25 14	(1.3)

26. Seals, Packings, Gaskets

Magnetic-Fluid Seals	Rosenweig, Miskolczy & Ezekiel	3/28 145	(6.0)
Inflatable Socks Restore Ruptured Raft	Scan	7/18 187	(0.5)

27. Valves

Basic Course in Hydraulic Systems:			
Part 6—Direction-Control Valves ..	Kauffman	5/9 179	(6.0)
Part 7—Direction Control Valve Application	Kauffman	5/23 197	(3.0)
Direction-Control and Servovalves	Smith	FP 9/19 43	(10.0)
Differential Pressure Sidelocks Ball Valve	Scan	8/15 178	(0.6)
Flow-Control Valves	Di Bartolo	FP 9/19 38	(5.0)
Pressure-Sensitive Cylinder Proportions Valve Flow	Scan	7/4 115	(0.6)
Basic Course in Hydraulic Systems:			
Part 9—Pressure-Control Valves ...	Kauffman	6/20 161	(5.0)
(continued)	Kauffman	7/4 123	(6.0)
Rupture Discs	Walmer	8/29 102	(5.0)
Pressure-Control Valves	Pippenger	FP 9/19 35	(3.0)
Servovalve Disciplines Mischievous Show-er	Scan	10/24 192	(1.0)
Nozzles Check Grinding-Wheel Wear ..	DIA	8/29 16	(0.5)

28. Instruments and Controls

Pressure Gages	Harland	FP 9/19 69	(6.0)
Cryogenic Flowmeters	DIA	10/24 56	(2.0)
Gyrating Sensor Field Averages Mixed Flow	Scan	8/1 111	(1.0)
Servodriven Balance 'Weighs' Liquid Depth	Scan	9/12 201	(1.6)
Fluidic Circuit Design	Dean	9/26 158	(9.0)
Fluidic Devices	Wood	FP 9/19 102	(8.0)
Fluidics Manages the Army's Records ..	N/T	4/11 16	(0.5)
Fluidic Thruster Steers A Barge	N/T	5/23 16	(1.0)
Rotating Disc Fashions Fluidic Wave-forms	Scan	11/21 153	(0.5)
Fluidic Logic Controls Automatic Assembly	Scan	12/19 114	(2.2)
A-C Fluidics	CD	11/21 163	(4.0)

29. Systems and Assemblies

Basic Instrumentation for Fluid Power Systems:

Part 1—Signal Generation	Henke & Johnson	1/4 110	(12.0)
Part 2—Signal Processing and Read-out	Henke & Johnson	2/1 100	(9.0)
Part 3—Electronic Counters and Recorders	Henke & Johnson	2/15 181	(7.0)

Basic Course in Hydraulic Systems:

Part 1—Introduction to Hydraulics ..	Kauffman	2/29 129	(5.0)
Part 2—Pumps and Their Application ..	Kauffman	3/14 180	(5.0)
Part 3—Pumps and Their Application (continued)	Kauffman	3/28 151	(5.0)
Part 4—Hydraulic Cylinders	Kauffman	4/11 229	(5.0)
Part 5—Rotary Actuators and Motors ..	Kauffman	4/25 173	(4.0)
Part 6—Direction-Control Valves ..	Kauffman	5/9 179	(6.0)
Part 7—Direction-Control Valve Application	Kauffman	5/23 197	(3.0)
Part 8—Flow-Control Valves	Kauffman	6/6 171	(6.0)
Part 9—Pressure-Control Valves ..	Kauffman	6/20 161	(5.0)
Part 10—Pressure - Control Valves (continued)	Kauffman	7/4 123	(6.0)
Part 11—Hydraulic System Fluids ..	Kauffman	7/18 185	(5.0)
Part 12—Fluid Conductors	Kauffman	8/15 168	(5.0)
Part 13—Fluid Conductors (continued)	Kauffman	8/29 107	(5.0)
Part 14—Fluid Conditioners—Strainers and Filters	Kauffman	9/12 197	(4.0)
Part 15—Fluid Conditioners — Heat Exchangers	Kauffman	9/26 167	(4.0)

EHD Lubrication	Zaretsky & Anderson	11/7 167	(7.0)
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Pneumatic Systems—Air Supply	Leibfritz	7/18 167	(4.0)
Pneumatic Systems—Air Preparation ..	Bracki	7/18 171	(5.5)
Pneumatic Systems—Air Control	Malinowski	7/18 176	(6.5)
Power Units	Engelbreton	FP 9/19 78	(2.0)

Understanding Hydraulic-System Shocks	Harsh	2/15 153	(4.0)
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Regenerative Air - Hydraulic Clamping System	Allard	8/1 99	(3.0)
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Noise in Air-Moving Systems	Kenny	9/26 138	(13.0)
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High Temperature in Hydraulic Systems	Hughes	12/19 134	(5.0)
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Fractional Boil-Off Triggers Mix Refill	Scan	4/11 250	(0.6)
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Hydrostatic Transmissions	Wilson	3/28 141	(4.0)
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Hydrostatic Lead Screws	Rumbarger & Wertwijn	4/11 238	(7.0)
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Hydrostatic Drives	Brown	FP 9/19 80	(3.0)
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Trends in Bearings and Lubrication ...	Rumbarger	B 6/13 3	(1.0)
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Lubricating Devices	Brehmer	B 6/13 63	(3.0)
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Jet Belt: Newest And Most Impressive of The Strap-On Flying Machines ..	N/T	7/8 10	(1.0)
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SST Engine Exceeds 63,200 lb of Thrust	N/T	10/24 10	(0.6)
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Design For Speed and Profit	Wise	11/7 36	(6.0)
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Smog, Steam, Government Fail to Dis-lodge IC Engine	N/T	2/15 44	(2.0)
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Superclean Air-Fuel Ratios Coming On GM Engines?	N/T	6/6 16	(0.6)
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New Piston Ring Solves Internal-Combustion Engine's Problems	N/T	8/1 32	(1.0)
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Natural-Gas Engine Powers Automatic Car Wash	DIA	5/23 38	(1.0)
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Two-Stage Wankel Goes To Sea	DIA	6/6 66	(0.5)
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Trucks Powered by Turbines Slated for Production in '70s	N/T	2/15 14	(0.6)
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Mechanical Drives, Controls and Systems

31. Engines, Atomic Power, Power Sources

The Race of the Super Atom-Smashers	Spector	2/15 28	(4.0)
Fireballs Without Fallout	N/T	4/11 72	(2.0)
Space Reactor Goes Critical	N/T	7/18 16	(0.6)
Man's Motions Steer New Minimum Rocket Vehicle	N/T	10/10 12	(0.6)
Turbine-Powered Truck	DI	11/7 30	(0.5)
Rig Simulates VTOL Ground Erosion...	DIA	6/20 57	(0.5)

Diffusion Process Could Mean Cheaper Nuclear Fuel	DI	10/24 50	(0.7)
Satellite Power?	CD	10/24 202	(3.0)
Model Rocket Mania	Article	12/5 30	(3.0)
Injected Hydrogen Cools Hybrid Rocket's Exhaust	N/T	11/7 10	(0.6)
Steam Is Back	Wise	8/29 20	(6.0)
Stirling-Electric Propulsion System Tried By GM	N/T	7/18 30	(1.6)
Vacuum Lifts Commuter Car	DIA	8/29 16	(0.5)

32-34. Drives, Transmissions, Drive Components

Perforated Tape Drives	Baird	4/11	234	(6.0)
Canted Rollers Vary Drive-Screw Pitch	Scan	5/23	162	(1.0)
Mechanical Adjustable-Speed Drives	Lavoie	9/12	185	(11.0)
Slack-Sensing Levers Maintain Pulley-Face Squeeze	Scan	5/9	160	(1.0)
Star-Wheel Actuator Steps Orbit Radius	Scan	5/9	161	(1.0)
Impulse Angle Controls Drive Speed	Scan	8/15	176	(1.0)
VW Adopts Automatic Transmission	DIA	2/1	40	(1.2)
Metal Conveyor Belts	Andrews	2/29	141	(7.0)
Avoiding Gear Overdesign	Pearson	5/9	153	(5.0)
Gear Materials: Ferrous Metals	Wellauer & Bergmann	6/20	144	(14.0)
Gear Materials: Nonferrous Metals	Lavoie	6/20	157	(4.0)
Customized Motions	Benford	9/26	151	(4.0)
Gears Are Not Perfect	Hahlbeck	11/21	146	(4.0)
Gear Quality	Koehler	12/19	123	(7.0)
Noncircular Gear Research Rolls On	DI	6/20	52	(1.0)
Gear Team Generates Parallel Shaft Shuttle	Scan	2/15	179	(1.0)

35. Rotational Components

Trends in Bearings and Lubrication	Rumbarger	B 6/13	3	(1.0)
Basic Bearing Types	DeHart	B 6/13	4	(3.6)
1-Turn Devices	Bickford	11/21	129	(4.0)
Misaligned Roller Bearings	Harris	8/29	98	(4.0)
Circular House Chooses Its View by Turning on Large Ball Bearing	N/T	1/18	16	(1.0)
Improving Bearing Reliability	CD	2/15	192	(2.0)
Rolling-Element Bearings	Anderson & Zaretaky	B 6/13	22	(18.0)
Specialty Bearings: Instrument Bearings	Pierson	B 6/13	40	(8.5)
Specialty Bearings: Premounted Bearings	Lower	B 6/13	46	(3.8)
Specialty Bearings: Rolling-Element Linear-Motion Bearings	Hope	B 6/13	50	(2.8)
Specialty Bearings: Large-Diameter Bearings	Greiner	B 6/13	53	(1.8)
Specialty Bearings: Unground Ball Bearings	Smith	B 6/13	54	(2.1)
Half-Stressing Design Doubles Bearing's Life	N/T	7/18	54	(0.6)

Gas-Bearing Applications	Gray	4/25	141	(19.0)
Plain Bearings	Glaeser	B 6/13	8	(7.0)
Gas Bearing Strives for Speed Records	N/T	5/9	14	(0.5)
Bushing Flex Refines Gear-Train Mesh	Scan	4/25	166	(1.0)
Roundup of Gas-Bearing Technology	CD	9/12	210	(4.0)
Roller Pair Orient Misaligned Insert	Scan	8/6	144	(1.0)
Stretched Sine Wave Freezes Flexible Arm	Scan	8/1	109	(1.0)
Retractable Axle Beats Land Laws	DIA	1/4	41	(0.5)
Unbalanced Shafts Generate Sine Torque	Scan	8/1	110	(0.5)
Self-Steering Axles Eliminate Trailer Jack-Knifing	Scan	12/19	113	(1.0)
12 Ways To Go 1 Way	Bickford	8/11	113	(4.0)
Cammed Levers Control One-Turn Clutch	Scan	3/14	174	(1.0)
Cammed Levers Cycle Clutch Output	Scan	5/23	163	(1.0)
Cam-Controlled Disc Transmits One-Way Torque	Scan	6/6	146	(0.6)
Energized Collar Starts-Stops Driveshaft	Scan	11/21	150	(1.0)
Fans and Blowers	Kenny	3/14	151	(23.0)
Optimizing Heat-Exchanger/Blower Combinations	Antonetti	9/12	169	(5.0)
Wobbling Gear Blocks Orbiting Piston Rotation	Scan	2/15	180	(1.0)
Cammed Dogs Permit Bidirectional Free-Wheel	Scan	3/26	158	(1.0)

36, 37. Mechanisms, Controls

Clamshell Seat Snaps Shut During Crash	N/T	8/29	10	(0.7)
Skier Schlusses or Walks with Cableless Safety Bindings	DIA	1/18	51	(0.5)
Variable-Geometry Linkage Sensitizes Actuator Touch	Scan	7/4	114	(1.0)
Pulsed Rocker Generates Stepped Drive	Scan	1/4	123	(0.5)
Piston-Ratchet Arrangement Tallies Air Pulses	Scan	12/5	142	(1.0)
Roller Adjustment Tunes-Up Nut-Screw Drive	Scan	11/21	153	(0.5)
Counterswinging Weights Erase Torsional Imbalance	Scan	2/1	114	(1.0)
Push-Pull Housing Adjusts Rotating Chuck	Scan	2/29	136	(0.5)
Cam Drive Resets Wheel	Scan	3/14	176	(1.0)
Shuttling Discs Select Transmission Speed	Scan	3/28	157	(1.0)

Assembly Components

41-43. Fasteners, Springs, Misc.

Why Bolts Loosen	Gambrell	10/24	163	(4.5)
Strength Of Fasteners To Rise in 1968 Standards	N/T	1/4	16	(1.0)
Fatigue Life Is Boosted for Industrial Fasteners	N/T	5/9	16	(0.5)
New Locking Fastener Never Vibrates	N/T	5/23	10	(0.5)
Loose Self-Locking Bolts	Fox	3/14	177	(3.0)
The Wide-Angle Thread	N/T	9/26	37	(2.0)
Eyelets	Dexter	7/18	183	(3.0)
Towing Strap Sustains Grip	Scan	2/1	115	(0.5)
Anchor Fingers Give Sea-Bottom Foothold	DIA	6/6	64	(1.0)
Maximum-Work Springs	Dilpare	7/4	111	(2.0)

Self-Optimizing Vibration Damper	Bonesho & Bollinger	2/29	123	(5.0)
Metal Foams For Vibration Damping ..	CD	7/4	130	(1.5)
New Ways to Soften Shock	Coppa	3/28	130	(11.0)
Deflection of Conical Springs	Kung	8/15	159	(2.0)
Magnetic Locks Can't Be Picked	DIA	3/14	74	(0.5)
Enclosures and Mounting Methods	(Chapter)	EM 3/21	5	(3.0)
Curious Tots Can't Get Into Lock-Lid Pill Container	DIA	4/11	74	(1.0)
Design for Speed and Profit	Wise	11/7	36	(6.0)
Foam-Filled Tire Never Goes Flat	N/T	4/25	10	(0.7)
Cable Weave Forms Flux-Field Barrier ..	Scan	7/4	113	(0.5)
Pneumatic Bladder Actuates Retractable Tire Studs	Scan	7/4	113	(0.5)
Landing Gear Takes Bumps, Then Slumps ..	DIA	3/14	99	(1.0)

Materials

51, 52. Ferrous, Nonferrous Metals

Plain-Bearing Materials	Booser	B 6/13	15	(7.0)
What Metal Is That?	Russell	8/15	161	(7.0)
High-Strength Low-Alloy Steels	Benzer	9/12	174	(11.0)
Vapor Deposition of Aluminum	CD	1/4	132	(2.0)
Magnesium Crankcase New Standard On Production Porsche-911	N/T	6/20	14	(0.5)
Titanium Castings	Harmsworth, McClaren & Cook	6/20	166	(6.0)

53, 54. Plastics, Rubber & Elastomer

The First Hundred Years	Dreger	P 12/12	3	(1.0)
Selecting Plastics	Dourlet	P 12/12	4	(7.6)
The Almost All-Plastic Car	N/T	1/18	12	(1.0)
All-Plastic Auto Ready for Production ..	N/T	12/5	16	(1.0)
Forging Thick Plastic Parts	CD	2/29	152	(1.0)
ABS	Whitney	P 12/12	39	(2.8)
Homopolymers	Ferguson	P 12/12	41	(1.9)
Copolymers	Black & Neff	P 12/12	43	(1.9)
Acrylics	Pierson	P 12/12	45	(1.7)
Cellulose Acetate	Black & Neff	P 12/12	47	(1.1)
Cellulose Propionate	Black & Neff	P 12/12	48	(1.0)

Ethyl Cellulose	Osteen	P 12/12	49	(1.8)
Cellulose Acetate Butyrate	Hill	P 12/12	51	(1.2)
Chlorinated Polyether	King	P 12/12	52	(1.0)
Ethylene-Vinyl Acetate	Pilaro	P 12/12	53	(1.0)
TFE-FEP Fluorocarbons	Brown, Holstein & Linton	P 12/12	54	(4.5)
CTFE Resins	Bringer	P 12/12	59	(2.0)
Ionomers	Kinsey	P 12/12	61	(1.0)
Nylons	Carswell	P 12/12	62	(3.0)
Parylenes	Gorham	P 12/12	65	(1.0)
Polyallomers	Vermillion	P 12/12	66	(1.0)
Polycarbonates	Rammrath	P 12/12	67	(1.6)
Polyethylenes	Poll	P 12/12	69	(3.0)
Polyimides	Todd, Hamlin, Mallouk & Courtright	P 12/12	71	(2.4)
Polypropylenes	Houston	P 12/12	72	(2.4)
Polystyrenes	Van Sickle	P 12/12	76	(2.6)
Polysulfones	Walton	P 12/12	79	(1.4)
Vinyls	Bulkley	P 12/12	80	(4.6)
Phenylene Oxides	Crowan	P 12/12	85	(1.0)
Fluorocarbons in Electronics	CD	2/1	124	(1.4)
Alkyls	Souza	P 12/12	86	(1.5)
Arylates	Beacham & Thomas	P 12/12	87	(2.0)
Aminos	Sunderland & Nufer	P 12/12	89	(2.9)
Epoxies	Madden	P 12/12	92	(1.7)
Phenolics	Bainbridge	P 12/12	94	(2.6)

Polyesters	Updegraff	P 12/12	96	(2.0)
Silicones	Weyer	P 12/12	98	(1.5)
Urethanes	Backus & Haag	P 12/12	100	(2.7)
Laminated Plastics	Muller	P 12/12	28	(4.0)
Reinforced Thermosets	Sprang & Davis	P 12/12	32	(2.7)
Reinforced Thermoplastics	Lachowecki	P 12/12	34	(4.3)
Structures of Reinforced Plastics	Fried	1/18	178	(6.0)
Sheet Solves Stamping Problems for High-Protection Fiber-Glass Cars ..	N/T	2/1	37	(0.6)
Designers Recruit From Filled-Plastics Family	Scan	11/21	152	(0.5)
Research in Plastic Composites	CD	3/28	162	(1.2)
Inflatable Spacecraft Gets A Rubber Window	N/T	12/19	16	(0.7)

55, 56. Joining Materials, Other Nonmetals

Anaerobic Adhesives	Kriebel	4/25	161	(5.0)
Nonmetal Shows Promise In Air-Frame Structures	N/T	7/4	14	(1.3)
Glassy Materials for Hydrospace	Pollock	1/18	174	(4.0)
Strength of Ceramics: New Tests Crack Up Old Concepts	N/T	2/1	38	(1.0)

Sprinkler System Guards Against Race-Car Fires	DIA	5/23	38	(1.6)
Sapphire Parts Grown 100 ft Long	N/T	12/5	12	(0.5)

57. Finishes, Coatings, Lubricants

Protective Coatings	Saroyan	1/18	188	(5.0)
Coatings for Electrical Circuits	CD	8/29	112	(1.5)
Organic Coatings for Aluminum	CD	3/14	188	(3.0)
Lubricants: Oils and Greases	Rollins	B 6/13	57	(2.7)
Lubricants: Solid and Bonded-Film Lubricants	DiSapio	B 6/13	59	(3.3)
Grease Lubricates A High-Speed Gyro ..	N/T	7/18	14	(1.3)

58. Prefabricated Forms

Clad Metals	Delagi	11/21	133	(3.0)
Porous Metal Parts	Johnson	4/11	235	(4.0)
Sandwich Panel Gets the Nod for DC-9's Quick-Change Floor	N/T	2/29	32	(0.5)
Snap-on Wear Strips	Carswell	2/1	119	(4.0)

Manufacturing Methods and Processes

61-63. Metals Casting, Shaping, Forming

Close-Tolerance Castings	Bouvier	2/29	137	(4.0)
Titanium Castings	Harnsworth, McClaren & Cook	6/20	166	(6.0)
A Case For Castings	Scan	12/5	144	(0.8)
Short-Run Diecastings	Polini	5/9	158	(2.0)
High-Velocity Forging: New Force in Gear Technology	Lavoie	12/5	146	(8.0)
Forging Thick Plastic Parts	CD	2/29	152	(2.0)
Aerospace Need A New Tool	N/T	7/18	58	(0.5)
Cold-Headed Parts	Zanin	8/1	95	(4.0)
Powder Steel Is Compacted Into Big Billets	N/T	1/4	50	(0.5)
Projecting Powder-Metal Progress ..	N/T	1/18	30	(2.0)
Forged Powder Metal Ready To Fly ..	N/T	7/4	12	(0.6)
Heat Treating Powder-Metal Parts ..	CD	6/20	180	(3.8)
Hollow Tube Of 'Any Shape' Cold Drawn From 'Any Metal'	N/T	9/12	32	(0.6)
Designing With Explosive Devices	Reinking	7/4	116	(7.0)
Huge Pressures Fill-In Defects Create New Types of Materials	N/T	9/26	12	(0.6)
Tubular Metal Parts	LeFell	12/5	152	(7.0)
Frozen Fill Forms Tube-Drawing Mandrel ..	Scan	1/4	124	(0.6)
Electroforming	Castellano & Woellmer	8/29	93	(5.0)

64-66. Metals Joining, Removal, Treating

Grown Together Joints Grow Up	Alm	1/4	100	(10.0)
Transition Insert Welds Aluminum to Steel	Scan	11/21	154	(0.6)
Electron Beam Takes Up Tunneling ..	N/T	6/6	57	(0.6)
Biggest of the Electron-Beam Welders ..	N/T	11/21	40	(0.7)
Inertia Welding	Kiwallie	11/7	161	(6.0)
Design for Numerical-Control Machining ..	Chandler	2/15	155	(22.0)
Machining the Unmachinable	CD	8/15	180	(3.5)
Heat Treating Powder-Metal Parts ..	CD	6/20	180	(3.8)

68. Plastics & Rubber Processes

Molding, Fabricating, and Decorating ..	Carlyon	P 12/12	17	(6.1)
Assembly Methods	Chapter	P 12/12	23	(4.8)
Plastic Profile Extrusions	Bordner, Fulmer & Meadows	6/6	154	(12.0)
Plastic-Encapsulation Debate	CD	11/7	192	(3.0)

Design Theory and Techniques

71-73. Mechanics, Strength of Materials and Parts

Design Fundamentals	Chapter	P 12/12	11	(5.4)
Mass Moment of Inertia	Pennist	1/4	125	(3.0)
A Soviet Scientist Looks At Machine Dynamics	DI	2/29	50	(1.0)
Mass Moment of Inertia	Angel	5/23	200	(1.0)
Vertical Vibrations Push Down Poles ..	DIA	3/14	74	(0.5)
Hinged Rod Pipes Sounds	Scan	2/29	148	(1.0)
Understanding Hydraulic-System Shocks ..	Harsh	2/15	153	(4.0)
Understanding Impact	Bickford	5/9	165	(8.0)
Noise in Air-Moving Systems	Kenny	9/26	138	(13.0)
Equations for Fracture Mechanics	Hofer	2/1	109	(5.0)
Load-Life Curves for Gear and Cam Material	Morrison	8/1	103	(7.0)
Understanding Photoelasticity	Rhol	10/24	168	(17.0)
Computer Stress Analysis	Rhol	11/21	136	(10.0)
Superplastic Metals Yield Some of Their Secrets	N/T	5/9	12	(0.5)
Parts That Bend and Twist	Little	11/7	174	(5.0)
Low-Frequency Fatigue Testing	Foxwell	5/9	175	(4.0)
Thermal Distortion	Romine & Morley	12/5	173	(3.0)
Defining Design Safety	Peters	2/29	128	(1.0)
Deflection in Gasketed Joints	Cook & Guerrerri	3/14	149	(2.0)
Predicting Burst Strength	Starr	8/15	173	(3.0)
Safe Loads For Thin-Wall Cylinders ..	Martineilli	8/1	116	(2.0)

74. Human Factors Engineering

Man vs. Car: Where Safety Research Stops	Wood	1/4	44	(3.0)
Technology for the Blind: Beyond the Stick and the Dot	Klein	2/1	20	(6.0)

The Health of Humans—4 The High Cost of Hospitals	Barnes	9/12	42	(6.0)
Spinning Zoo Never Stops for Service ..	N/T	3/14	12	(0.6)
Head-to-Toe Protection	N/T	3/14	30	(3.0)
Students in a Tank Survive 60-Day Space Mission	N/T	5/23	29	(2.0)
Garments A Go Go	N/T	6/6	28	(2.0)
Machine Rates Healthy, Tired, And Drunk Drivers	N/T	9/12	16	(0.6)
Dummies Just Don't Act Human	N/T	12/5	14	(1.3)
Discotheque Comes Home	N/T	12/19	30	(2.0)
Engineers Cash In On Art Trend	N/T	12/19	35	(1.0)
Hydraulics Tries Its Hand	DIA	2/29	24	(3.0)
Smog	DI	3/14	44	(1.0)
Special Report: Products Liability	Wise	3/28	20	(16.0)
Auto Industry Seeks Lead in Safety Race	N/T	2/1	14	(1.3)
Car-Carried Sand Sprinkler Reduces Skids	DIA	6/6	66	(0.5)

75. Design Analysis and Synthesis

Measuring Design Intangibles	Schermerhorn & Taft	12/19	109	(5.0)
Basic Course in Numerical Methods:				
Lesson 5—Matrix Inversion	Ekstrom	1/4	129	(3.0)
Lesson 6—Jacobi Iterative Method ..	Ekstrom	1/18	193	(2.0)
Lesson 7—Eigenvalues of Matrices ..	Ekstrom	2/1	116	(3.0)
Lesson 8—Nonlinear Equations	Ekstrom	2/15	189	(3.0)
Lesson 9—Euler-Cauchy Methods	Ekstrom	2/19	149	(2.0)
Lesson 10—Runge-Kutta Method	Ekstrom	3/14	185	(2.0)
Lesson 11—Initial-Value Problems ..	Ekstrom	3/28	159	(3.0)
Lesson 12—Finite Differences	Ekstrom	4/11	245	(3.0)
Lesson 13—Boundary-Value Problems ..	Ekstrom	4/25	177	(3.0)
Lesson 14—Elliptic Equations	Ekstrom	5/9	185	(3.0)
Lesson 15—Parabolic Equations	Ekstrom	5/23	201	(3.0)
Lesson 16—Hyperbolic Equations	Ekstrom	6/6	177	(3.0)
Lesson 17—FORTRAN Programs	Ekstrom	6/20	175	(5.0)

Generating Polygons with Hypocycloids	Tuttle	5/9	173	(2.0)
LMS Makes Flights of Fancy	N/T	2/29	28	(3.0)
The Aerodynamics of Buildings	N/T	10/10	42	(3.0)
Time-Sharing or Small Computer?	Sackman	11/7	149	(9.0)
Engineer's Guide to Time-Sharing	Lavoie	2/29	114	(7.0)
Technology Comes To Wall Street	Klein	9/12	20	(7.0)
Calculators and Computers	Lavoie	10/10	184	(7.0)
Computer Stress Analysis	Khol	11/21	136	(10.0)
Computer Draws All the Action In One-Car Crash	N/T	4/25	16	(0.6)
Computer Communications to Mushroom Machine Plays With Blocks Learns To Solve Problems	N/T	5/23	8	(0.7)
Computer's Voice Sounds More Human	N/T	6/20	37	(0.5)
Creative Design With a Computer	N/T	12/19	41	(0.5)
Shading Computer-Drawn Solids	CD	5/23	204	(1.6)
Time-Sharing vs. Batch Processing	CD	7/18	202	(2.6)
Assigning a Value to Human Reliability	Williams	7/4	102	(9.0)
Reliability vs. Design	CD	10/10	223	(5.5)

76. Basic Sciences

Probing Secrets Of The Atom	Spector	6/6	38	(5.0)
'Earth-Orbiting' Sun Helps Broaden Radio Spectrum	N/T	6/6	10	(0.7)
Musical Flame Plays A Tape Recording.. Taming Temperature	Zoppa & Bonkowski	1/4	14	(0.6)
Moon-Landing Areas Are Analyzed by Infrared	N/T	12/5	159	(8.0)
Radiation Around the Home	Spector	5/23	60	(0.6)
Microwave Expert Sounds All-Radiation Alarm	N/T	4/11	46	(6.0)
Effects of Marine Organisms	Muraoka	7/18	56	(0.7)
The Health Of Humans:		1/18	184	(4.0)
Part 1—Parts For People	Barnes	6/20	40	(7.0)
Part 2—Artificial Organs	Barnes	7/18	20	(7.0)
Part 3—Supercars	Barnes	8/15	40	(8.0)
Part 4—The High Cost of Hospitals	Barnes	9/12	42	(8.0)
Shape-Up The Ergometric Way	Wood	10/24	42	(4.0)
Muscle-Stump Signals Guide Artificial Arm	N/T	9/26	16	(0.6)
Mth's Radiation Detector Called Good Design Job	N/T	9/26	10	(0.7)

Doctors Look at Thinner Slice of Life .. Exoskeleton Measures Slick-Muscle Power	DIA	2/15	54	(1.0)
Optomechanical Design	N/T	7/18	56	(0.6)
	Hayes, Ulrich, Brockway, Durie, & Yoder	5/23	165	(32.0)
New Oscillator Provides Key To Continuous Optical Communications	N/T	6/20	32	(0.6)
Pulsing Light Guides Cable-Planting Plov Bouncing Sound Measures Materials Properties	DIA	9/12	64	(1.0)
	N/T	1/18	28	(1.0)

78. Environmental Design

Contamination Control	Burgess	10/24	193	(7.0)
War On Foul Air	N/T	12/19	38	(1.0)
Metals and Corrosion	Brown	1/18	165	(9.0)
Stress Corrosion	Kirkpatrick, Gegel & Lynch	7/18	188	(7.0)
Marine Corrosion	Tuthill	12/19	117	(6.0)
Reducing Corrosion Failures	CD	8/11	120	(2.0)
Apollo 8: A Conservative Mission	Wise	12/19	20	(7.0)
Orbiting-Laboratory Mockup Goes Back 'On Station'	N/T	2/15	34	(0.6)
Will Man Ever Pilot Apollo?	N/T	2/29	12	(0.6)
LMS Makes Flights of Fancy	N/T	2/29	28	(3.0)
Flying on the Moon	N/T	3/14	56	(3.0)
Indoor Oxygen Squirter Anchors Space-Man To Work Station	N/T	6/6	37	(1.0)
Latest Design Unveiled for Manned Mars Lander	N/T	11/7	16	(0.7)
Grenade-Lobbing Module To Test Moon's Surface	DIA	3/14	72	(1.0)
Quest in the Innerspace	Waters	1/18	153	(7.0)
Deep-Submergence Metal Structures	Woodland	1/18	159	(6.0)
Tools for Working in Water	Wood	3/14	20	(8.0)
Mining Marine Minerals	Barnes	4/25	21	(6.0)
The Great Gulf Stream Drift	(Article)	6/20	28	(2.0)
Submarine Rescue	Wood	6/6	29	(4.0)
Sealab III: Deeper And Longer	Barnes	10/24	29	(8.0)
Deep-Diving Work Boat Slides Down The Ways	N/T	10/24	12	(1.0)
Nothing Fancy Allowed in New Submarine Design	N/T	10/24	16	(0.5)

Engineering Management, Personal

81. Engineering Department Operations

Job Shopping: Route to Wealth or Worry?	Josephs	1/4	94	(6.0)
Calculate the Profitability Index	Rondeau	2/1	88	(8.0)
You Need 'Overkill' in Communications.. Problems With Communications:	D'Aprix	2/15	150	(3.0)
Mismanaging the Process	Raudsepp	3/14	144	(5.0)
Getting through to Supervisors	Raudsepp	3/28	126	(4.0)
Channeling Technical Information	Raudsepp	4/25	138	(3.0)
Planning and Layout	Smith	10/10	176	(8.0)
Business Can't Be All Bad	N/T	2/29	8	(0.6)
Engineering Quality Determines Company's Salability	N/T	3/14	8	(0.7)
Self-Analysis for Managers	CD	1/18	196	(4.0)
R&D as a Mini-Company	CD	4/11	286	(6.8)
Plan Ahead To Make Research Pay	Stanford	7/18	157	(7.0)
Don't Send An Engineer To Do a Technician's Job	Hayes	8/1	86	(4.0)
NSPE Hits Labor-Board Decisions	NT	6/6	8	(0.5)
Don't Evaluate Without the Facts	Rexroad	2/29	121	(2.0)
Advanced Degrees	Raudsepp	10/24	158	(5.0)
Technical Talent Wasted By Military Services	N/T	1/4	8	(0.7)
No Increase Forecasted in 1968 Demand for Engineers	N/T	5/9	8	(0.6)
Teaching—Good Administration—Better.. Hiring Engineers? Make Sure They're Contented	N/T	8/15	8	(0.7)
Class of '68 Is No Bumper Crop	NT	11/21	8	(0.5)
How's Your Management Potential?	Raudsepp	12/5	138	(4.0)

82-84. New Products, Drafting, Testing

Organize Against Product Failure	Landers	6/6	136	(8.0)
Affluent Leisure	Klein	7/4	20	(16.0)
Making the Most of Design Reviews	Burgess	7/4	90	(6.0)
Industrial Espionage				
Part 1—The Big Steal	Spector	8/15	20	(7.0)
Part 2—The Security Game	Spector	8/29	42	(6.0)
Congress Pushes for Stiffer Product Guarantees	N/T	2/15	8	(1.0)
Synergistic Society Boosts Technical Progress	N/T	6/6	8	(0.5)
Wescon Industrial Design Awards	N/T	8/15	30	(3.0)
Budgeting and Control of Development Projects	Rasmussen	8/29	78	(4.0)
Geometric Dimensioning	Levy	9/12	204	(5.0)
Swinging T Rolls Out Gear-Tooth Profiles	DIA	1/4	40	(1.0)
Shading Computer-Drawn Solids	CD	7/18	202	(2.6)
How To Build an Adjustable Ellipsograph	Pittwood	6/20	173	(2.0)
Drafting Machines	Lavoie	10/10	191	(7.0)
Equipment Roundup	(Article)	10/10	214	(8.0)
Lettering Typewriter Snaps Onto Drafting Machine	N/T	9/12	10	(0.5)

Reproduction Equipment	Griffith	10/10	198	(9.0)
Microfilm Equipment	Griffith	10/10	207	(7.0)
Basic Instrumentation for Fluid Power Systems: Part 1—Signal Generation	Henke & Johnson	1/4	110	(12.0)
Low-Frequency Fatigue Testing	Foxwell	5/9	175	(4.0)
Understanding Photoelasticity	Khol	10/24	168	(17.0)
Aircraft Are Needed to Gather Smog Data	N/T	1/18	35	(0.5)
Glass Road Tips Off Tire-Design Secrets	N/T	12/19	12	(0.7)
Skewed Wheels Check Road Friction	DIA	6/20	57	(0.7)
Tester Monitors Golf-Ball Liveliness	DIA	9/12	62	(2.0)

85, 86. Technical Information, Patents

Avoid Design Duplication	Gatzow	7/18	152	(5.0)
Fingerprint Analysis	N/T	6/6	30	(3.0)
Television Replaces The Filing Cabinet.. NABAS Gets 'Modern' Information Retrieval System	N/T	9/28	8	(0.6)
You and Information Retrieval	CD	4/25	180	(1.3)
What's Wrong With IR?	CD	12/5	178	(2.7)
New Status for Standardization	Gille	6/20	134	(5.0)
Measuring Conformance to Standards	Heyson	9/12	164	(5.0)
Engineering Project Reports	Mait	11/7	157	(4.0)
Ten Million Bits of Data on One Square Inch of Film	N/T	1/4	50	(0.5)
Greek Numbers Game	Coleman	2/15	188	(1.0)
Patent Reforms Go Before Senate Subcommittee	N/T	2/1	10	(0.5)

87, 88. Personal, Professional, Outside Services

How To Sharpen Your Listening Skills .. As Others See Us	Raudsepp	5/9	148	(5.0)
Cultural Revolution Hits Scientific Community	Gattis	8/15	136	(7.0)
Attributes of a Good Supervisor of Creative Engineers	DI	8/15	58	(0.7)
Environment for Creativity	Raudsepp	8/1	90	(5.0)
Creative Problem Solving	Raudsepp	9/26	124	(5.0)
Clues to the Creative Mind	Raudsepp	11/21	124	(5.0)
'Amateur' Inventors Show What They've Thought Up	N/T	4/25	44	(2.0)
'68 Design Show and Conference: Old Records Will Fall	N/T	10/24	38	(1.0)
Chaos in Engineering	N/T	3/28	46	(1.0)
Togetherness Flops at EJC	Klein	5/23	20	(6.0)
World Engineering Group Formed	N/T	2/1	8	(1.2)
New National Engineering Society Proposed	N/T	4/25	8	(1.0)
Engineers Want Strong, Unified Organization	N/T	8/29	8	(0.6)
Don't Let the P.E. Exam Scare You .. Using an Outside Consultant	N/T	11/7	8	(0.7)
	Polentz	4/11	212	(6.0)
	Kelsey	5/23	158	(4.0)

Specific Machines and Equipment

911. Ordnance

Special Report: Our Changing Arsenal	Aronson	5/9	20	(21.0)
Small-Cannon Comeback	Crossman	8/1	37	(7.0)
Moving The Marines	Aronson	12/5	20	(8.0)
The Case Of The Caseless Cartridge	N/T	1/4	20	(2.0)
Third Rocket Type Flies Right on First Try	N/T	2/1	12	(0.5)
Cheyenne Pilot Will Blast The Enemy by Looking At Him	N/T	3/14	14	(0.6)
Paper Missile Teaches Defensive War	N/T	8/15	10	(0.7)
Infantry Trains With "Toy M-16s"	N/T	10/24	37	(1.0)
Rocket Motor Boosts Artillery-Snell's Range	N/T	11/7	35	(1.0)

912. Machinery

Conveyor Belt Does the Thinking for New Materials-Handling System	N/T	1/4	55	(0.6)
Any Typist Can Use First Braille Type-writer	N/T	2/29	16	(0.6)
Walking Dragline Takes 325-Ton Bites	N/T	10/10	14	(0.7)
Picker Parts Peas From Pods	DIA	1/18	50	(0.9)
Ship Goes "Upstairs" for Repair	DIA	2/15	56	(0.8)
Push-Button Bar Has 1,000-Drink Repertoire	DIA	5/23	37	(1.0)
"Coconut Lathe" Eliminates Hand-Shell-ing Operation	DIA	10/10	50	(1.0)
Table Tilt and Jiggle Separates Spheres From Chips	Scan	9/12	202	(0.6)

913. Electrical Machinery

Interstellar Eavesdropping	Wise	1/18	20	(6.0)
The Battle of the Sound Systems	Spector	3/14	46	(5.0)
Outlook For Communications	Klein	11/7	19	(5.0)
Picturephone Gets New Gimmicks	N/T	1/4	32	(0.9)
Toward The Automated Home	Spector	11/21	20	(13.0)
Tune Played On Telephone Spells Mes-sages For Deaf	N/T	1/18	35	(0.5)
Disposable X-Ray Tube Takes Sharp 'Flash' Pictures	N/T	2/1	28	(0.6)
Home-Appliance Maker Sketches Re-searcher's Dreams	N/T	2/15	41	(1.0)
TV Lights the Night with Bounced Picture	N/T	3/14	10	(0.7)
Matchbox-Size Radar Ushers in New Microwave Uses	N/T	4/11	10	(1.0)
Beeper Becomes Receiver, Finds Lost Skiers	N/T	4/25	52	(0.5)
Europe Gets New Air-Defense Nerve Center	N/T	5/9	62	(0.5)
Home TV Talks About And Shows Slides	N/T	6/6	60	(0.5)
1,600-lb Satellite Relays Military's Mes-sages	N/T	6/29	16	(0.5)
TV Display Watches Circling Aircraft	N/T	7/18	37	(0.7)
Newspaper Delivered by Telephone	N/T	9/12	58	(0.5)
ART Will Watch The Store For You	DIA	1/4	40	(0.5)
Printer Spits Out 1,200 Words Per Minute	DIA	2/1	42	(1.0)

914. Transportation

The Maritime Mess	Barnes	1/4	22	(6.0)
The Army's Wacky Watercraft	Barnes	2/15	20	(5.0)
The Great Turbine Derby	Wise	5/23	42	(8.0)

Straight Up And Away	Wood	6/20	20	(6.0)
Just Getting Off The Ground	Eglen	7/18	40	(5.0)
Flying Cars that Hug the Ground	Wood	8/1	20	(7.0)
Year of the Supercar	Wise	10/10	20	(12.0)
Design For Speed and Profit	Wise	11/7	36	(6.0)
All-Plastic Auto Ready for Production	N/T	12/5	16	(1.0)
Doing Your Thing With A Thermal	Aronson	12/5	37	(7.0)
AMX Enters Performance-Car Race	N/T	2/15	10	(0.6)
Prestige in a Smaller Package	N/T	2/15	16	(1.0)
Shrouded Prop Guides Ships Through Turns	N/T	2/15	37	(0.6)
C-5A Galaxy Makes Debut	N/T	2/29	20	(3.0)
Concrete Boats	N/T	4/11	44	(2.0)
Aircraft's Long Nose Pokes for New Truth	NT	4/25	32	(0.5)
New Jet Gets Personalized Luggage	N/T	5/23	57	(0.6)
The Great Transcontinental Electric-Car Race	N/T	8/15	50	(3.0)
Nobody Gets Seasick Aboard Two-Hull Ship	N/T	8/29	32	(0.5)
Diary Of A Race	N/T	9/26	20	(11.0)
Go-Carts For Divers	N/T	9/26	42	(3.0)
C-5 Transport Delivers Its Own Dock	N/T	10/10	40	(0.6)
Thompson Ready For Speed-Record Try in 2,000-hp "Arrow"	N/T	11/21	42	(3.0)
Swing-Away Bogies Make Landing Easier	DIA	1/18	50	(0.6)
Outrigger Sailboat Gives Added Safety	DIA	4/11	76	(0.7)
Swiveling Rear Wheels Cause Artificial Skids	DIA	6/20	58	(0.6)
V/STOL Lacks Financial Fuel	DIA	7/4	48	(2.0)
Four-Track Robot Follows Complex Paths	DIA	10/10	48	(2.0)
The Search for a Supertrain	DI	2/15	48	(3.0)
Europe Looks to V/STOL Fighters and Transports	DI	5/23	66	(1.0)
Comrade: Be Sure To Test Drive The '68 Zaporozhets	DI	6/6	50	(2.0)
The Bug Gets A Bigger Brother	DI	7/18	48	(0.6)
Rubber-Boat Armada	DI	9/26	52	(1.0)
'69 Bug Features Minor Alterations	DI	10/10	57	(0.7)

915. Instruments

Driverless Cars, Automated Roadways	Wood	4/11	20	(8.0)
Flat Hologram Shows Walk-Around View	N/T	4/11	12	(0.7)
X-Ray Checks Mock Meteoroid for Accuracy	N/T	4/11	41	(0.7)
Point-and-Shoot Camera Performs Professional Tricks	DIA	1/18	53	(1.0)
Magnetic Clamp Controls Wrench Torque	Scan	10/24	167	(0.5)

916. Fabricated Metal Products

Arrow Spins Trail From Bow To Target	DIA	7/18	62	(0.7)
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990. Miscellaneous

Technology Invades the Arts	Klein	2/28	37	(7.0)
Sea City Could Ease Population Problem	DI	6/20	50	(1.0)

Using the classification system provides nine major (one-digit) classifications, each of which has up to nine (two-digit) sub-classifications. These, in turn, are divided into ten (three-digit) indexing classifications.

Indexing classifications ending in 0 (General) are used to index material concerning several or all indexing classifications ending in 1 through 8. Classifications ending in 9 (Other) are used for material falling within the sub-classification but not within any of the items 1 through 8.

MACHINE DESIGN Subject Classification System

1-ELECTRICAL & ELECTRONIC

- 11 Motors**
 - 110 General
 - 111 Fractional (less than 1 hp)
 - 112 Ac integral horsepower
 - 113 Dc integral horsepower
 - 114 Universal (dc and ac)
 - 115 Multispeed
 - 116 Gearmotors
 - 117 Torque
 - 118 Definite and special purpose
 - 119 Other
- 12 Power Supplies**
 - 120 General
 - 121 Batteries (dry and wet)
 - 122 Dc generators, motor-generators
 - 123 Ac generators (alternators), motor-generators
 - 124 Converters, inverters
 - 125 Transformers
 - 126 Fuel cells, solar cells, photo cells
 - 127 Thermoelectric supplies
 - 128
 - 129 Other
- 13 Switches & Relays**
 - 130 General
 - 131 Mechanical (pushbutton, lever, rotary, mercury)
 - 132 Thermally operated (thermostats)
 - 133 Pressure operated
 - 134 Limit
 - 135 Proximity, photoelectric
 - 136 Stepping
 - 137 Relays, circuit breakers
 - 138 Motor starters (motor controls)
 - 139 Other (reed)
- 14 Instruments & Controls**
 - 140 General
 - 141 Sensing devices (transducers, thermocouples)
 - 142 Solenoids, electric actuators
 - 143 Timers, timing motors, delays
 - 144 Synchros
 - 145 Instrument motors
 - 146 Data recorders, readouts, indicators
 - 147 Meters, gages
 - 148 Servo motors, stepping motors
 - 149 Other
- 15 Circuit Components**
 - 150 General
 - 151 Resistors (rheostats, potentiometers)
 - 152 Capacitors
 - 153 Inductors
 - 154 Solid-State devices (diodes, transistors, SCR's, rectifiers, semiconductors, integrated circuits)
 - 155 Tubes
 - 156 Saturable reactors (magnetic amplifiers)
 - 157 Fuses
 - 158 Lasers, masers
 - 159 Other
- 16 Connectors & Wiring**
 - 160 General
 - 161 Rings, brushes, commutators
 - 162 Terminals, binding posts
 - 163 Contacts (buttons)
 - 164 Plugs, receptacles, connectors
 - 165 Wiring (cable, cord, coil, harness)
 - 166 Printed circuits, stitched circuits
 - 167
 - 168
 - 169 Other
- 17 Miscellaneous Components**
 - 170 General
 - 171 Electromagnets, magnets
 - 172 Chassis, control panels
 - 173 Insulation, encapsulation, shielding
 - 174 Cooling elements
 - 175 Lamps, lighting elements (fiber optics)
 - 176 Heaters, heating elements
 - 177 Electric clutches & brakes
 - 178
 - 179 Other
- 18 Systems & Assemblies**
 - 180 General
 - 191 Amplifiers, preamps
 - 192 Control systems (regulators, numerical control)
 - 193 Electronic computers
 - 194 Other electronic
 - 195 Adjustable-speed drives
 - 196 Servomechanisms
 - 197 Other electromechanical
 - 198 Packaging
 - 199 Other

2-FLUID POWER

- 21 Fluids**
 - 210 General
 - 211 Hydraulic fluids
 - 212 Coolants
 - 213
 - 214
 - 215
 - 216
 - 217
 - 218
 - 219 Other
- 22 Fluid Conditioners**
 - 220 General
 - 221 Fluid storage (pressure vessels)
 - 222 Filters, strainers
 - 223 Renovators
 - 224 Heat exchangers
 - 225 Coolers
 - 226 Heaters
 - 227 Driers
 - 228
 - 229 Others
- 23 Fluid Conductors**
 - 230 General
 - 231 Tubing (pressure)
 - 232 Hose
 - 233 Pipe
 - 234 Fittings
 - 235 Joints, couplings
 - 236
 - 237
 - 238
 - 239 Other
- 24 Linear Devices**
 - 240 General
 - 241 Cylinders
 - 242 Accumulators
 - 243 Intensifiers
 - 244 Actuators (bellows, diaphragms)
 - 245 Pumps (linear)
 - 246
 - 247
 - 248
 - 249 Other
- 25 Rotary Devices**
 - 250 General
 - 251 Pumps (rotary)
 - 252 Fluid Motors
 - 253 Air motors
 - 254 Compressors
- 26 Seals**
 - 260 General
 - 261 Materials seals (O-rings)
 - 262 Mechanical seals
 - 263 Gaskets
 - 264 Wiper rings
 - 265 Packings
 - 266
 - 267
 - 268
 - 269 Other
- 27 Valves**
 - 270 General
 - 271 Direction control
 - 272 Flow control
 - 273 Pressure control (relief)
 - 274 Servo valves
 - 275 Valve blocks (manifolds)
 - 276 Nozzles
 - 277
 - 278
 - 279 Other
- 28 Instruments & Controls**
 - 280 General
 - 281 Test stands
 - 282 Control panels
 - 283 Meters, gages
 - 284 Switches
 - 285 Transducers (to hydraulic)
 - 286 Regulators
 - 287 Fluidic devices
 - 288
 - 289 Other
- 29 Systems & Assemblies**
 - 290 General
 - 291 Industrial hydraulic & pneumatic systems
 - 292 Mobile, aircraft, marine
 - 293 Hydrodynamic drives
 - 294 Hydrostatic drives
 - 295 Vacuum
 - 296 Lubrication
 - 297 Hydraulic, pneumatic computers
 - 298
 - 299 Other
- 255 Rotary actuators**
 - 256
 - 257
 - 258
 - 259 Other

3-MECHANICAL

- 31 Power Sources**
 - 310 General
 - 311 Jet engines
 - 312 Internal-combustion engines
 - 313 Turbines
 - 314 Atomic, nuclear power
 - 315 Exotic fuel engines (rockets)
 - 316 Fuels, propellants
 - 317
 - 318
 - 319 Other
- 32 Constant-Speed Drives & Transmissions**
 - 320 General (speed reducers)
 - 321 Chain
 - 322 Belt
 - 323 Friction (ball, disc, wheel, cone)
 - 324 Gear
 - 325
 - 326
 - 327
 - 328
 - 329 Other
- 33 Adjustable-Speed Drives & Transmissions**
 - 330 General (speed reducers)
 - 331 Chain
 - 332 Belt
 - 333 Friction (ball, disc, wheel, cone)
 - 334 Gear
 - 335
 - 336
 - 338
 - 339 Other
- 34 Drive Components**
 - 340 General
 - 341 Transmission chain, cable
 - 342 Belts, belting
 - 343 Gears, gearing
 - 344 Sprockets
 - 345 Pulleys, sheaves
 - 346 Conveyor chain, conveyor cable
 - 347 Conveyor screws
 - 348
- 349 Other**
- 35 Rotational Components**
 - 350 General
 - 351 Antifriction bearings (ball, roller, needle)
 - 352 Sleeve bearings (gas, solid-lubricant), bushings
 - 353 Flexible couplings, universal joints, flexible shafts
 - 354 Torque converters, fluid couplings
 - 355 Shafts, axles, splines, pinions, crankshafts
 - 356 Clutches, brakes
 - 357 Fans, blowers
 - 358
 - 359 Other
- 36 Mechanisms**
 - 360 General
 - 361 Cams
 - 362 Linkages
 - 363 Intermittent-motion (periodic-motion, indexing)
 - 364 Three dimensional
 - 365 Motion converters (leadscrews)
 - 366 Spring motors
 - 367
 - 368
 - 369 Other
- 37 Controls**
 - 370 General
 - 371 Push-pull
 - 372 Transducers (to mechanical)
 - 373 Gyros, gyroscopes
 - 374 Counters
 - 375
 - 376
 - 377
 - 378
 - 379 Other
- 38 Systems**
 - 390 General

4-ASSEMBLY COMPONENTS

- 41 Fasteners**
 - 410 General
 - 411 Inserts
 - 412 Nuts
 - 413 Pins
 - 414 Quick operating (panel-type, latches)
 - 415 Retaining rings, keys, collars
 - 416 Rivets
 - 417 Screws, bolts, studs
 - 418 Washers, grommets, eyelets
 - 419 Other (spring clips, clamps)
- 42 Springs & Isolation Devices**
 - 420 General
 - 421 Fluid & air springs
 - 422 Helical-wire springs
 - 423 Leaf springs
 - 424 Vibration isolators, mounts
 - 425 Hydraulic-damping devices (shock absorbers, snubbers)
- 43 Miscellaneous**
 - 430 General
 - 431 Locks
 - 432 Nameplates, labels
 - 433 Dials, knobs, handles
 - 434 Shims
 - 435 Enclosures
 - 436 Wheels, tires, rollers, casters
 - 437 Slides
 - 438 Hinges, brackets
 - 439 Other
- 49 General**
 - 490 General
- 426 Mechanical-damping devices**
 - 427
 - 428
 - 429 Other

5-MATERIALS

- 51 Ferrous Metals**
 - 510 General
 - 511 Cast iron, malleable iron, cast carbon, alloy steels
 - 512 Wrought carbon, alloy steels
 - 513 Free-machining steels
 - 514 Stainless steels, high alloys, high-temperature steels
 - 515 Specialty steels (tool, die, electrical)
 - 516
 - 517
 - 518
 - 519 Other
- 52 Nonferrous Metals**
 - 520 General
 - 521 Aluminum
 - 522 Copper, Brass, Bronze
 - 523 Magnesium
 - 524 Nickel
 - 525 Titanium
 - 526 Zinc
 - 527 Refractory metals (tungsten, tantalum, molybdenum, columbium)
 - 528 Precious metals
 - 529 Other
- 53 Plastics**
 - 530 General
 - 531 Thermoplastic plastics (nylon, Teflon)
 - 532 Thermosetting plastics (epoxy, phenolic, filled silicones, rigid urethanes)
- 54 Rubber & Elastomer**
 - 540 General
 - 541 Natural rubber
 - 542 Synthetic rubber
 - 543 Elastomeric plastics (flexible silicones & urethanes)
 - 544 Hard rubber
 - 545
 - 546
 - 547
 - 548
 - 549 Other
- 55 Joining Materials**
 - 550 General
 - 551 Adhesives, sealants
 - 552 Welding rods
 - 553 Brazing, soldering alloys
 - 554
 - 555
 - 556
 - 557
 - 558
 - 559 Other
- 533 Laminated plastics, vulcanized fiber**
 - 534 Reinforced, filled plastics
 - 535
 - 536
 - 537
 - 538
 - 539 Other

5-MATERIALS (continued)

- 56 Other Nonmetals
- 560 General
- 561 Carbon, graphite
- 562 Glass, ceramics
- 563 Refractory materials, mica
- 564 Carbides, cermets
- 565 Mineral & synthetic fibers, felt
- 566 Insulating materials (thermal)
- 567 Wood, cork, composition board, paper
- 568 Chemicals
- 569 Other
- 57 Finishes, Coatings & Lubricants
- 570 General
- 571 Metallic coatings
- 572 Chemical coatings, electrochemical coatings
- 573 Organic finishes (lacquers, synthetic enamels), paints, varnishes
- 574 Porcelain enamels, vitreous coatings
- 575 Plastic coatings
- 576 Lubricating materials
- 577
- 578
- 579 Other
- 58 Prefabricated Forms
- 580 General
- 581 Film, tape, sheet, foil
- 582 Wire, wire cloth, wire rope, cable
- 583 Patterned, perforated, expanded metals
- 584 Laminates (other than laminated plastics)
- 585 Composite materials
- 586 Structures (honeycomb, foam, sandwich)
- 587 Structural shapes (tubing, channels)
- 588 Balls
- 589 Other
- 59 General
- 590 General

6-MANUFACTURING PROCESSES

- 61 Metal Casting
- 610 General
- 611 Sand
- 612 Shell mold
- 613 Permanent mold
- 614 Centrifugal
- 615 Investment
- 616 Die
- 617
- 618
- 619 Other
- 62 Metal Shaping
- 620 General
- 621 Forging
- 622 Extrusion, impact extrusion
- 623 Heading, upsetting
- 624 Thread, form rolling
- 625 Powder metallurgy
- 626
- 627
- 628
- 629 Other
- 63 Metal Forming
- 630 General
- 631 Sheet, plate forming
- 632 Stamping, drawing
- 633 High-velocity forming (explosive forming)
- 634 Spinning
- 635 Roll forming
- 636 Tube forming
- 637 Wire forming
- 638
- 639 Other
- 64 Metal Joining
- 640 General
- 641 Arc welding
- 642 Gas welding
- 643 Resistance welding
- 644 High-energy welding (plasma, electron beam, explosive bonding)
- 645 Flame cutting
- 646 Brazing
- 647 Soldering
- 648 Adhesive joining, bonding
- 649 Other
- 65 Metal Removal
- 650 General
- 651 Planing, broaching
- 652 Lathe, screw machining
- 653 Milling, hobbing, gear shaping
- 654 Drilling, boring
- 655 Grinding, abrasive machining
- 656 Honing, lapping, polishing
- 657 High-energy machining (spark, laser)
- 658
- 659 Other
- 66 Metal Treating
- 660 General
- 661 Heat treating
- 662 Surface treating (carburizing, nitriding)
- 663 Shot peening, surface working
- 664 Chemical milling, etching
- 665
- 666
- 667
- 668
- 669 Other
- 67 Finishing
- 670 General
- 671 Chemical, solvent cleaning
- 672 Mechanical finishing
- 673 Conversion coating (anodizing) electro-polishing
- 674 Electroplating, vacuum metallizing
- 675 Metal spraying (flame spraying), hard facing
- 676 Painting
- 677
- 678
- 679 Other
- 68 Plastics & Rubber Processes
- 680 General
- 681 Molding
- 682 Extrusion
- 683 Sheet forming
- 684 Laminating
- 685 Casting
- 686 Stamping, machining, fabricating, forming
- 687 Calendaring, coating
- 688 Encapsulation
- 689 Other (filament winding)
- 69 General
- 690 General

7-DESIGN THEORY & TECHNIQUES

- 71 Mechanics
- 710 General
- 711 Statics (at rest)
- 712 Dynamics (force to create motion)
- 713 Kinematics (motion in abstract)
- 714 Vibration
- 715 Shock
- 716 Noise, sound, music
- 717
- 718
- 719 Other
- 72 Strength of Materials
- 720 General
- 721 Elastic theory
- 722 Plastic theory
- 723 Fatigue, endurance
- 724 Creep
- 725 Impact stress
- 726 Thermal stress
- 727 Friction
- 728
- 729 Other
- 73 Strength of Parts
- 730 General
- 731 Tension, compression
- 732 Bending
- 733 Shear, torsion
- 734 Surface contact stress
- 735 Plates
- 736 Cylinders, columns
- 737 Rotating discs
- 738
- 739 Other
- 74 Human-Factors Engineering
- 740 General
- 741 Styling
- 742 Color
- 743 Safety
- 744 Illumination
- 745 Human limitations
- 746
- 747
- 748
- 749 Other

7-DESIGN THEORY & TECHNIQUES (continued)

- 75 Design Analysis & Synthesis
- 750 General
- 751 Mathematical methods (statistics)
- 752 Graphical techniques
- 753 Analog, models
- 754 Computer techniques
- 755 Reliability, quality control
- 756 Dimensioning (tolerances)
- 757
- 758
- 759 Other
- 76 Basic Sciences & Fields
- 760 General
- 761 Physics
- 762 Chemistry
- 763 Thermal (cryogenics, heat transfer)
- 764 Radiation
- 765 Biosciences
- 766 Optics (photography)
- 767 Ultrasonics
- 768
- 769 Other
- 77 Experimental Design
- 770 General
- 771 Prototypes, breadboards
- 772 Testing (stress analysis)
- 773
- 774
- 775
- 776
- 777
- 778
- 779 Other
- 78 Environmental Design
- 780 General
- 781 Corrosion, rust
- 782 Mold, fungus
- 783 Outer space
- 784 Under sea
- 785
- 786
- 787
- 788
- 789 Other
- 79 General
- 790 General

8-ENGINEERING MANAGEMENT & OPERATION

- 81 Engineering Department Operations
- 810 General
- 811 Structure, organization
- 812 Costs
- 813 Programing, planning
- 814 Personnel policies
- 815 Recruiting, evaluation, training
- 816 Managerial talent
- 817 Compensation
- 818
- 819 Other
- 82 New Product Development
- 820 General
- 83 Drafting & Reproduction
- 830 General
- 831 Management, control systems
- 832 Drafting practices, techniques
- 833 Technical illustration
- 834 Drafting equipment
- 835 Reproduction equipment, systems
- 836 Furniture
- 837
- 838
- 839 Other
- 84 Laboratory & Testing
- 840 General
- 85 Technical Information
- 850 General
- 851 Engineering libraries, files
- 852 Information classification, retrieval
- 853 Specifications, standards
- 854 Report writing, articles, papers, oral
- 855 Part numbering
- 856 Engineering records
- 857
- 858
- 859 Other
- 86 Patents & Patent Law
- 860 General
- 87 Personal & Professional
- 870 General
- 871 Creativity, inventiveness
- 872 Meetings, shows
- 873 Other personal
- 874 Societies
- 875 Professional licensing
- 876 Unions
- 877
- 878
- 879 Other professional
- 88 Outside Services
- 880 General
- 881 Engineering design services
- 882 Industrial design services
- 883
- 884
- 885
- 886
- 887
- 888
- 889 Other
- 89 General
- 890 General

9-MISCELLANEOUS

- 91 Complete Machines
- 910 General
- 911 Ordnance (tanks, missiles, rockets, ammunition, SIC 19)
- 912 Machinery (agricultural, construction, machine tools, office machinery, materials handling, SIC 35)
- 913 Electrical machinery (communications, radio radar, TV, appliances, X-ray, SIC 36)
- 914 Transportation (automotive, aircraft, ships, railroad, SIC 37)
- 915 Instruments (medical, dental, photographic, watches, SIC 38)
- 916 Fabricated metal products (hand tools, etc., SIC 34)
- 917
- 918
- 919 Other
- 99 Unclassified
- 990 General
- (includes pages such as Editorials, "Back Talk," Covers, Contents Pages, etc.)

